REGION 5 RAC2

REMEDIAL ACTION CONTRACT FOR

Remedial, Enforcement Oversight, and
Non-Time Critical Removal Activities at Sites of Release
or Threatened Release of Hazardous Substances in Region 5

FINAL
Screening-Level Ecological Risk Assessment
Ten-Mile Drain Superfund Site
St. Clair Shores, Macomb County, Michigan
Remedial Investigation/Feasibility Study

WA No. 165-RICO-B5BP/Contract No. EP-S5-06-01

February 2016

PREPARED FOR

U.S. Environmental Protection Agency

PREPARED BY

ch2m

Ecology and Environment, Inc.
Environmental Design International, Inc.
Teska Associates, Inc.

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Executive Summary

This screening level ecological risk assessment (SLERA) was prepared for the Ten-Mile Drain (TMD) site in St. Clair Shores, Michigan, which consists of residential areas near the TMD potential source area and the canals downstream of the TMD. The suspected polychlorinated biphenyl (PCB) source area of the TMD site is mostly covered by an asphalt parking lot. Surface and stormwater collect in the TMD storm sewer system and discharge to Lange and Revere Street canals of St. Clair Lake. Data from historical investigation activities conducted by the Michigan Department of Environmental Quality, City of St. Clair Shores, United States Environmental Protection Agency (EPA) since 2010 were used to complete this SLERA.

The SLERA was conducted in accordance with EPA guidance (EPA 1992, 1997, 1998). The data generated from the investigation activities were used to assess both lower trophic level (direct exposure) and upper trophic level (food web exposure) risks for a variety of terrestrial and aquatic receptors using multiple lines of evidence in a weight-of-evidence (WOE) process. The WOE process includes assessing risk estimates in context with the extent, magnitude, and ecological significance of each line of evidence.

Based on the WOE evaluation, total PCBs were identified across all assessment endpoints for aquatic receptor exposure scenarios (lower and upper trophic levels) as a chemical of potential ecological concern (COPEC), in the Lange and Revere canals surface water and sediment.

The WOE evaluation presented in this SLERA identified that the sediment and surface water COPEC, total PCBs, requires consideration in the feasibility study (FS) based on risk to semiaquatic wildlife populations, benthic invertebrate, and water-column biota communities, including forage fish.

Based on the WOE evaluation, total PCBs were not identified as presenting unacceptable ecological risk in upland terrestrial soils.

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Acronyms and Abbreviations

BAF	bioaccumulation factor
BCF	bioconcentration factor
BERA	baseline ecological risk assessment
BSAF	biota-sediment accumulation factor
bgs	below ground surface
CH2M	CH2M HILL
COPC	chemicals of potential concern
COPEC	chemical of potential ecological concern
CRL	Central Regional Laboratory
CSM	conceptual site model
EC&T	Environmental Consulting & Technology, Inc.
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ESV	ecological screening value
FIELDS	**FI**eld **E**nvironmental **D**ecision **S**upport
FIR	food ingestion rate
FS	feasibility study
HQ	hazard quotient
kg	kilogram
LOAEL	lowest observed adverse effect level
MATC	maximum allowable toxic concentrations
MCPWO	Macomb County Public Works Office
MDEQ	Michigan Department of Environmental Quality
µg/L	microgram per liter
mg/kg	milligram per kilogram
NOAEL	no observed adverse effect level
PCB	polychlorinated biphenyl
RI	remedial investigation
SLERA	screening level ecological risk assessment
TCRA	time critical removal action
TMD	Ten-Mile Drain
TRV	toxicity reference values
UCL	upper confidence limit
WIR	drinking water ingestion rate
WOE	weight-of-evidence

SECTION 1

Introduction

1.1 Project Description

This screening-level ecological risk assessment (SLERA) was prepared for the Ten-Mile Drain (TMD) Site in St. Clair Shores, Michigan (Figure 1-1). The area assessed consists of terrestrial habitat within residential and commercial areas near the suspected TMD source area and aquatic habitat within the canal downstream of the TMD. This SLERA was conducted according to U.S. Environmental Protection Agency (EPA) guidance for ecological risk assessments (ERAs) (EPA 1992, 1997, 1998). This SLERA was performed to evaluate TMD data collected between 2010 and 2013.

1.2 Site Location

The TMD site is northeast of the city of Detroit. The site is in a mixed commercial/residential area in St. Clair Shores, Macomb County, Michigan. The majority of the TMD site encompasses a several-block area bounded by Bon Brae Street on the north, Harper Avenue on the west, Ten-Mile Road on the south, and Jefferson Avenue on the east, along with the TMD outfall and the Lange and Revere Street canals. It includes a majority of the TMD storm sewer system, which consists of concrete sewer pipes and soil surrounding the pipes in a utility corridor extending to approximately 15 feet below ground surface (bgs). The storm sewer discharges into the Lange and Revere Street canals, which are connected to the western side of Lake St. Clair. The canals, which provide recreational boating access to Lake St. Clair for approximately 125 homes, are private property and used for recreational boating, swimming, and fishing. The TMD system and investigation areas included in this SLERA are depicted on Figure 1-1.

1.3 Site History

Polychlorinated biphenyl (PCB) contamination was initially identified in the Lange and Revere Street canal sediments in August 2001 when the Macomb County Public Works Office (MCPWO) collected sediment samples as part of a dredge permit application. In February 2002, MCPWO traced PCB contamination back to the TMD outfall in the Lange Canal and into the TMD. MCPWO requested that EPA assist in determining the source of PCB contamination. In March 2002, EPA began source investigation at the TMD site. In June 2002, based on analytical results as high as 121,000 milligrams per kilogram (mg/kg) of PCBs near the intersection of Bon Brae Street and Harper Avenue, it was hypothesized that the PCB contamination was likely because of an illegal discharge to the TMD near the Bon Brae Street/Harper Avenue intersection. In the fall of 2002, EPA and MCPWO dewatered and cleaned the drain, removing sediments with PCB concentrations as high as 200,000 mg/kg.

In February 2005, PCB contamination was again detected in the drain, and MCPWO requested assistance from EPA in reevaluating the source of the PCB contamination. In May 2005, the Michigan Department of Environmental Quality (MDEQ) and EPA installed 64 additional soil borings in suspected areas of concern near the Bon Brae Street/Harper Avenue intersection. In 2006, EPA dewatered the TMD, removed impacted sediment, and installed approximately 1,000 feet of cured-in–place pipe liner within the storm sewer near the Bon Brae Street/Harper Avenue intersection.

In 2008, MDEQ conducted an investigation during which collocated surface water and sediment data were collected from the Lange and Revere Street canals, as well as in the immediate vicinity of Lake St. Clair. Samples were analyzed for PCBs. No detections of PCBs were observed in surface water, except at a single location immediately adjacent to the TMD outfall. These data are not included in the quantitative evaluation of the ecological risk in surface water of the Lange and Revere Street canals because a comprehensive sediment investigation was completed in 2011 to demonstrate current conditions.

In December 2009, MCPWO discovered PCB-contaminated oil with a concentration of approximately 800,000 milligrams per liter of PCBs within the cured-in-place pipe-lined portion of the drain. In December 2009, EPA placed oil collection snares within the sewer system to prevent migration of the oil to the Lange and Revere Street canals.

In March 2010, EPA initiated removal of PCB-contaminated oil from within manhole vaults of the TMD storm sewer system and placed 15 weirs within the TMD to inhibit future migration of PCB-impacted sediments or oil in the TMD system. EPA also installed 43 additional soil borings at several properties near the Bon Brae Street/Harper Avenue intersection, the locations of which were based on public tip information regarding potential historical sources of contamination. From April 2010 to August 2011, surface water samples were collected from the TMD drainage outlet at the Lange and Revere Street canals. Samples were collected following the methods outlined in the *Monitoring and Remedial Measures for the 10 Mile Drain Site* (Environmental Consulting & Technology, Inc. [EC&T] 2011). Over this sampling period, total PCB concentrations in the outlet samples ranged from 0.69 to 8.2 micrograms per liter (µg/L). EC&T noted that these results are consistent with historical concentrations (maximum concentration sampled in 2004 was 9.5 µg/L), and appear to be highest following drain cleanings (completed in 2004 and 2010) (EC&T 2011).

The EPA Field Environmental Decision Support (FIELDS) Team conducted sediment sampling characterization activities in 2011 at the Lange and Revere Street canals (EPA 2012) to assess the current extent of PCB contamination in canal sediments.

The 2013 remedial investigation (RI) activities were conducted to further evaluate the nature and extent of PCB contamination in soil and support the selection of a remedy that eliminates, reduces, or controls risks to human health and the environment. The primary focus of the RI was the area near Harper Avenue along Bon Brae Street and Lakeland Street, and the residential properties adjoining the Lange and Revere Street canals.

1.4 Site Features

The TMD site and surrounding area is relatively flat with little topographic relief. The TMD site and surrounding area slopes to the east-southeast at approximately 5 feet per mile and does not contain any notable topographical relief features. There is no groundwater aquifer present within 20 feet of ground surface at the site based on borings installed in native soils located outside the TMD and other utility corridors during the RI and previous investigations (CH2M HILL [CH2M] 2011).

An asphalt parking lot currently covers the suspected source area of PCBs to the TMD. Surface water in the suspected source area and across the TMD site is collected in the TMD storm sewer system and discharges to Lange and Revere Street canals of Lake St. Clair.

1.5 Document Organization

The remainder of this report is organized as follows:

- **Section 2—Screening-Level Problem Formulation.** Provides an overview of the site history and habitats at the TMD site, presents the conceptual site model (CSM), and identifies the assessment/measurement endpoints and the receptors identified for evaluation in the SLERA. Corresponds to Step 1 of the 8-step ecological risk assessment (ERA) process for Superfund (EPA 1997).

- **Section 3—Exposure Assessment.** Profiles the spatial and temporal patterns and magnitude of exposure for detected chemicals in relation to the assessment endpoints and risk questions.
- **Section 4—Effects Assessment.** Presents an analysis of the lines of evidence for existing and potential adverse effects of site-related contamination on the assessment endpoints. Step 2 of the 8-step ERA process for Superfund (EPA 1997).
- **Section 5—Risk Characterization.** Presents the integration of exposure and effects for lower trophic level receptors. Includes a screening level effects calculation to establish conservative thresholds for adverse ecological effects. Chemicals of potential concern (COPCs) are identified at this final step of the SLERA.
- **Section 6—Baseline Ecological Risk Assessment (BERA).** Presents the refinement of the COPCs (Step 3a), in which the conservative assumptions used in the SLERA are refined and risk estimates are recalculated using the same CSM. The COPC refinement is divided into two categories—a refinement of the direct exposure to aquatic and soil organisms evaluation, and a dose-based food-web modeling to higher trophic level wildlife. The BERA also includes the risk description.
- **Section 7—Uncertainty.** Documents the major sources of uncertainty associated with the estimation and description of risk.
- **Section 8—Summary and Conclusions.** Presents an overall summary of the SLERA results and decision outcomes for the SLERA areas of focus.
- **Section 9—References.** Presents full citations for the literature referenced in the SLERA.

SECTION 2

Screening-Level Problem Formulation

This section presents the problem formulation for the site, which establishes the goals, scope, and focus of the SLERA. It summarizes the site history and ecological setting of the TMD in terms of the habitats and biota known or likely to be present and the types of chemicals present in ecologically relevant media. The CSM is presented to provide an understanding of chemical sources, transport pathways, exposure media, exposure pathways and routes, and ecological receptors. Assessment endpoints were developed to identify receptors for which complete exposure pathways exist and summarize methods that will be used to evaluate potential risks to those receptors.

2.1 Ecological Setting and Habitats

The TMD site and surrounding area consists of developed residential neighborhoods and commercial properties. Terrestrial habitat is limited and characterized by vegetation primarily consisting of landscape plants, grasses, and trees in residential parkways and yards. Soil invertebrates, such as earthworm and insects, and upper trophic level biota, such as birds (for example, robin, sparrow, and blackbird) and small mammals (for example, mice and voles), are expected to use these habitats. Overall, the habitat quality is poor because of the residential nature of the site. Because of the poor quality of the site and its size, it is not expected to support significant populations of wildlife receptors.

Aquatic habitat is present in the Lange and Revere Street canals, which are connected to Lake St. Clair. The canals, which provide recreational boating access to Lake St. Clair for approximately 125 homes, are private property and used for swimming and fishing. The canal shorelines consist of bulkheads that limit shallow water habitat. Water depths range from 4 to 12 feet (EPA 2012). The canals are covered with soft sediment with thicknesses ranging from less than 6 inches to more than 9 feet (EPA 2012). Because of the lack of habitat diversity, a limited benthic macroinvertebrate and fish community is expected in the canals.

A current federal- and state-listed threatened and endangered species list potentially occurring in Macomb County, Michigan, is presented in Table 2-1 (U.S. Fish and Wildlife Service 2014; Michigan Natural Features Inventory 2014). A review of this list indicates that there is currently no known occurrence of the species within the TMD site because of a lack of suitable habitat.

2.2 Conceptual Site Model

The CSM relates potentially exposed receptor populations with potential source areas based upon physical site characteristics and completed exposure pathways. Important components of the CSM are the identification of potential source areas, transport pathways, exposure media, exposure pathways and routes, and receptor groups. Actual or potential exposures of ecological receptors associated with a site are determined by identifying the most likely and relevant pathways of contaminant release and transport. A complete exposure pathway has the following three components: (1) a source of contaminants that results in a release to the environment, (2) a pathway of contaminant transport through an environmental medium, and (3) an exposure or contact point for an ecological receptor. The main objective of the CSM is to identify any complete and critical exposure pathways that may be present at the site. Figure 2-1 illustrates a diagrammatic CSM for the TMD site. Key components of the CSM are discussed in the following subsections.

2.2.1 Source Area

Manhole M-7179, located near the intersection of Harper Avenue and Bon Brae Street, historically has contained the highest concentration of PCB-contaminated oil/sediment at the TMD site.

A machine shop formerly operated on the property at [redacted] Harper Avenue, which currently is occupied by Fresenius Health Clinic, is considered a potential source area by EPA and MDEQ because of the historical operations. Currently, the property at [redacted] Harper Avenue is mostly covered by asphalt parking lot. Thirty-five borings were installed on this property and adjacent right-of-way areas during this phase of the RI. Potential historical illegal dumping to the TMD also is considered a potential source of contamination to the TMD. No definitive source of PCBs to the TMD have been identified, although there does not appear to be an ongoing source to the drain itself, and the backfill material around the TMD appears to be acting as a secondary source that is continuing to recontaminate the TMD system.

2.2.2 Transport Pathways and Exposure Media

A transport pathway describes the mechanisms whereby site-related contaminants, once released, might be transported from a source to ecologically relevant media (soil, sediment, and surface water), where exposures might occur to ecological receptors. The transport pathways are shown on Figure 2-1.

Multiple potential pathways of contaminant migration from the TMD are identified on the CSM.
The potential transport pathways can contribute to the spread of contamination from the site. Historical erosion and runoff of contaminated site soils caused by stormwater may have carried contaminants to the residential area. Likewise, particle aerosolization because of wind scouring could transfer airborne particles to downwind residential locations. Contaminants can be released from the source area soil through infiltration and discharged to the storm sewer system, which then carries it into sediment and surface water at the Lange and Revere Street canals of Lake St. Clair.

2.2.3 Exposure Pathways and Routes

An exposure pathway links a source with one or more receptors by one or more media and exposure routes. Exposure, and thus potential adverse effects, can occur only if a complete exposure pathway exists. Figure 2-1 shows the potentially complete exposure pathways to ecological receptors that are evaluated in this SLERA.

Upper trophic level receptors (birds and mammals) can be exposed through dietary ingestion of contaminants taken up by food items from soil, sediment, and surface water, as well as by any incidental ingestion, direct contact (dermal contact), and/or inhalation. Soil-, water column-, and sediment-dwelling organisms can receive significant exposure through direct contact (including incidental ingestion), and dietary ingestion of bioaccumulative and non-bioaccumulative contaminants in soil, sediment, and surface water.

Plants can be exposed through direct contact with contaminants in soil/sediment. Direct contact for vegetation is assumed to include contact that may occur through uptake of soil contaminants into the plants' root systems, or leaf absorption of contaminants evaporating from the soil or from windborne foliar deposition of soil. Terrestrial and aquatic organisms can be exposed through direct contact with contaminated soil, sediment, and surface water.

The relative importance of the exposure routes depends in part on the chemical being evaluated.
The greatest exposure to birds and mammals for bioaccumulative chemicals is likely from the ingestion of prey.

Dermal and inhalation exposures were not evaluated quantitatively in the SLERA for upper trophic level receptors because of the limited availability of exposure models and effects data. Based on the protection offered by hair or feathers, dermal exposures following deposition to sediment for upper trophic level receptor species are not expected to be significant relative to ingestion exposures. Incidental ingestion of soil and sediment during feeding activities, however, were considered in the risk estimates. Direct contact was considered for lower trophic level receptors, such as invertebrates.

2.2.4 Receptors and Assessment and Measurement Endpoints

Because of the complexity of natural systems, it is generally not possible to directly assess potential impacts to all ecological receptors present within an area. Therefore, a limited number of receptor species or species groups were selected as surrogates to represent the larger components of the ecological community. Receptor selection was guided by the results of the site habitat characterization, resident species information from site visits, and consideration of whether the potential receptors meet the following criteria:

- Are known to occur or are likely to occur at the site
- Have a particular ecological, economic, or aesthetic value
- Are representative of a taxonomic group (life history traits and/or trophic levels in the habitats present at the site for which complete exposure pathways are likely to exist)
- Are rare, threatened, or endangered
- Can be expected to represent potentially sensitive populations at the site because of toxicological sensitivity or potential exposure magnitude
- Have available sufficient ecotoxicological information on which to base an evaluation

Lower trophic level receptor species were selected for evaluation based on the taxonomic groupings for which medium-specific screening values have been developed. The groupings and screening values are used in most ecological risk assessments. Fish, plant, and invertebrate communities were selected as terrestrial and aquatic receptors for assessment endpoints. The receptors are routinely addressed in aggregate through a comparison to soil, surface water, sediment, and fish tissue residue screening values.

Ecological risk endpoints define ecological attributes that are to be protected (assessment endpoints) and measurable characteristics of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has occurred or could occur. Assessment endpoints most often relate to attributes of biological populations or communities and focus the risk assessment on particular components of the ecosystem that could be adversely affected by contaminants from a site (EPA 1997). Assessment endpoints contain an entity (such as worm-eating birds) and an attribute of that entity (such as survival rate).

For each assessment endpoint, selection of surrogate species and level of biological organization assessed in this SLERA were based on consideration of the habitats and ecological receptors potentially occurring onsite. The assessment and measurement endpoints are summarized in Table 2-2.

2.3 Summary of Available Data

Data used in this SLERA included site-specific abiotic media collected between 2010 and 2015 as described in the RI/feasibility study (FS) work plan (CH2M 2012), *Lange and Revere Street Canals Sediment Sampling Report* (EPA 2012), *Monitoring and Remedial Measures for the 10 Mile Drain Site* (EC&T 2011), and *2011 Source Area Investigation Data Summary Report* (CH2M 2011). The data are summarized in the following paragraphs.

Aroclor data were collected in each medium. Aroclor data then were used to calculate a total PCB for each sample. Nondetected concentrations were assumed to equal zero in the summation of surface water Aroclor data and for individual Aroclors that were detected in five or less samples in soil and sediment. For those individual Aroclors detected in greater than five samples in soil and sediment samples, one-half the detection limit was used in the total PCB summation.

- Sediment
  - PCB-1016 (more than 200 detections), one-half the detection limit for nondetects
  - PCB-1232 (0 detection), 0 for nondetects
  - PCB-1242 (0 detection), 0 for nondetects
  - PCB-1248 (5 detections), 0 for nondetects
  - PCB-1254 (0 detection), 0 for nondetects
  - PCB-1260 (25 detections), one-half the detection limit for nondetects
- Soil
  - PCB-1016 (1 detections), 0 for nondetects
  - PCB-1232 (0 detection), 0 for nondetects
  - PCB-1242 (3 detection), 0 for nondetects
  - PCB-1248 (more than 200 detections), one-half the detection limit for nondetects
  - PCB-1254 (39 detection), one-half the detection limit for nondetects
  - PCB-1260 (0 detections), 0 for nondetects

2.3.1 Residential Property Surface Soil

Residential soil characterization data used in this SLERA were collected during the RI (CH2M 2016). Figures 2-2, 2-3, and 2-4 present the locations of the soil samples, and Tables 2-3 and 2-4 present analytical data from the surface soil locations used in this SLERA. In 2013, a geostatistical sampling approach was used to assess whether 57 residential properties were impacted with PCBs. Each yard area was assessed as an individual decision unit. The geostatistical sampling approach consisted of collecting soil cores from borings spaced on a 14-foot triangular grid across each yard area, with a minimum of eight borings per yard area. Soil was collected from each boring at 6-inch intervals from 0 to 3 feet bgs. Initially, soil cores from each yard area were homogenized into one sample for the following 6-inch intervals: 0 to 0.5 feet bgs, 1 to 1.5 feet bgs, and 2.5 to 3 feet bgs. The homogenized sample intervals were analyzed for PCBs by EPA's mobile laboratory. Based upon the results of the initial sample analyses, additional intervals from some yards were selected for analysis. In addition, confirmatory split sampling was conducted by EPA's Central Regional Laboratory (CRL) at a 10 percent frequency for accuracy verification of mobile laboratory analytical results. All residential soil concentrations were grouped into one area of concern for the SLERA.

2.3.1.1 Bon Brae Street Soil Sampling

Residential properties along Bon Brae Street were sampled based on their proximity to historical near-surface PCB contamination present near the corner of Harper Avenue and Bon Brae Street. Twelve properties were sampled along Bon Brae Street between Harper Avenue and E Street (Figure 2-2). Additionally, three back yards ([redacted] Bon Brae Street, [redacted] Bon Brae Street, and [redacted] Bon Brae Street) were sampled based on elevated PCB levels detected on the adjacent commercial property located at [redacted] Harper Avenue.

2.3.1.2 Lange and Revere Street Canals Soil Sampling

Residential properties along Lange and Revere Street canals were sampled based on the potential use of canal water for lawn or garden irrigation. Twenty-seven properties were sampled using the geostatistical sampling approach along the canals (Ten Mile Road—3 properties; Lange Street—18 properties; Revere Street—6 properties). The back yard between the sea wall and the back of the residential structures (Figure 2-3) for each selected property was sampled and analyzed for PCBs by EPA's mobile laboratory.

2.3.1.3 Lakeland Street Soil Sampling

Residential properties along Lakeland Street were sampled based on elevated PCB levels detected on the commercial property located at [redacted] Harper Avenue, which also fronts Lakeland Street. Eighteen properties were sampled along Lakeland Street east of Harper Avenue (Figure 2-4). Because of the size of the parkway/green space areas (area between street curb and sidewalk), the parkway and front yards were sampled as separate decision units. Three back yards on the northern side of Lakeland Street ([redacted], [redacted], and [redacted] Lakeland Street) also were sampled based on elevated PCB levels detected on the adjacent commercial property located at [redacted] Harper Avenue and analyzed for PCBs by EPA's mobile laboratory or the CRL.

An attempt was made to gain access to all residential properties on Lakeland Street east of Harper Avenue up to the point where PCBs were no longer detected in the yards ([redacted] and [redacted] Lakeland Street). Some property owners did not provide access. Properties where access was not received are labeled "No Access" on Figure 2-4.

A time-critical removal action (TCRA) will be completed at six residences ([redacted] Lakeland [backyard], [redacted] Lakeland [parkway], [redacted] Lakeland [parkway], [redacted] Lakeland [parkway], [redacted] Lakeland [parkway], and [redacted] Lakeland [parkway]). These sample locations are not included in this SLERA.

2.3.1.4 Former Martin Drain

Soil sampling was conducted across 7 transects of the former Martin Drain (surface drain replaced by the current Ten-Mile Drain system) to determine whether PCB contamination is present within the relic drainage channel (long since backfilled), and evaluate if the former Martin Drain is responsible for PCB contamination previously detected within the Lakeland and Rio Vista canals (MDEQ 2009).

Sampling was performed using direct-push technology drilling to collect 2-inch-diameter soil cores in acetate liners. Soil cores from ground surface to 10 feet bgs were collected and processed as outlined in the quality assurance project plan (CH2M 2013). Sample transects were located one on either side of Bon Brae Street, 2 on the west side and one on the east side of B Street, and one on either side of Jefferson Avenue (Figures 2-5 through 2-7). Transect locations were selected based upon historical aerial photographs, which provided the approximate historical location of the former Martin Drain. Up to two discrete samples were collected from each core location and analyzed for PCBs.

2.3.2 Lange and Revere Street Canals Sediment

In January 2011, a comprehensive sediment investigation was completed to assess the current conditions of the Lange and Revere Street canals (EPA 2012). A total of 146 sediment samples was collected at the surface (0 to 0.5 foot bgs) (Figure 2-8). All samples were analyzed for PCBs. An aquatic evaluation was completed on the data, which were grouped into one area of concern under this SLERA (Tables 2-5)

2.3.3 Ten-Mile Drain Outfall Surface Water

Field activities in March and April 2010 included the dewatering, cleanout, and weir installation in the TMD sewer lines (EC&T 2011). From April 2010 to August 2011, surface water samples were collected from the TMD drainage outlet (Figure 2-3). Five surface water samples were collected and analyzed for PCBs. An aquatic evaluation was completed on the data (Tables 2-6) for this SLERA.

2.3.4 Lake St. Clair Fish

In April 2010, MDEQ collected fish within the immediate vicinity of the Lange and Revere Street canals. Thirty-eight fish fillet samples were analyzed for PCBs in wet weight (Table 2-7). All fish tissue residue data (bluegill [*Lepomis macrochirus*], carp [spp. unknown], pumpkinseed [*Lepomis gibbosus*], walleye [Sander vitreus], small mouth bass [*Micropterus dolomieu*], and yellow perch [*Perca flavescens*]) were used in the evaluation of direct exposure toxicity to the fish community for this SLERA. Some uncertainty, discussed further in Section 7, is associated with using fish fillets from non-forage fish in the ecological evaluation.

SECTION 3

Exposure Assessment

The exposure assessment identifies exposure pathways associated with the representative receptor species listed in Section 2.2.4.

3.1 Direct Exposure

Receptors such as terrestrial plants, invertebrates (terrestrial and aquatic), and water-column biota are exposed primarily through direct contact with sediment, surface water, and/or soil. The exposure estimates were assessed based on chemical concentrations in applicable media to which the receptors might be exposed. In addition to surface water-based water-column biota criteria, fish tissue residue screening values were used to evaluate forage fish. The exposure estimates were assessed based on chemical concentrations in fish tissue residue.

Maximum media/tissue residue concentrations initially were used in the SLERA to conservatively estimate the potential chemical exposure point concentrations (EPCs) for the ecological receptors selected to represent the assessment endpoints. The EPCs were compared with the corresponding ecological screening values (ESVs) to derive screening risk estimates.

Chemicals of potential ecological concern (COPECs) were identified using the hazard quotient (HQ) method. HQs were calculated by dividing the EPC (the maximum for detected chemicals) by the corresponding screening value. Chemicals with screening value-based HQs greater than or equal to 1 are considered COPECs. Chemicals for which toxicological data were not available were not identified as COPECs, but are addressed in the uncertainty section.

For analytes that failed the screening, additional evaluation was completed as part of the refinement step (in the BERA). At this step, consideration was given to additional weights-of-evidence (WOEs). Estimates of exposure for these receptors may be represented as particular concentrations of COPECs in abiotic media (soil, sediment, and surface water) or tissue residue. Therefore, both an upper confidence limit (UCL)-based EPC and the entire distribution of values were selected as suitable EPCs resulting in a potential for point-by-point evaluation for each of the receptors.

3.2 Food Web Exposure

Because PCBs are bioaccumulative, concentrations were evaluated for food-web (wildlife) exposures. Exposures for avian and mammalian receptor species, by the food web, were determined with measured or estimated chemical-specific concentrations in each dietary component and applying them to food-web models. The methodologies used for calculations of dietary exposure are outlined in the following subsection.

3.2.1 Dietary Intake

Upper trophic level receptor exposures by food webs to total PCBs present in surface soil, surface water, and sediment at the site were estimated concentrations of plant, invertebrate, and vertebrate prey items in each relevant dietary component for each receptor. Incidental ingestion of soil or sediment was included when calculating the total exposure. Surface water, as a source of drinking water, was included in the total exposure calculation.

The dietary dose (intake) for each upper trophic level receptor was calculated using the following formula taken from Suter et al. (2000):

Et = [[Sj * Ps * FIR] + [Bij * Pi * FIRDW] + [SWj * WIR]]

Where:

E_t	=	total dietary exposure (mg/kg per day)
S_j	=	concentration of chemical (j) in soil or sediment (mg/kg dry weight)
Ps	=	soil or sediment ingestion as proportion of dry-weight diet
FIR_{DW}	=	species-specific food ingestion rate (kilogram [kg] food per kg body weight per day – dry-weight basis)
B_{ij}	=	concentration of chemical (j) in biota type (i) (mg/kg dry weight)
P_i	=	proportion of biota type (i) in wet-weight diet[1]
SW_j	=	concentration of chemical (j) in surface water (milligrams per liter)
WIR	=	species-specific water ingestion rate (liters of water per kg body weight per day)

3.2.2 Model Parameterization

To apply the above exposure model, the following model parameters must be defined.

- **Wildlife Exposure Parameters**—The specific life history parameters required to estimate exposure of bird and mammal receptors to the COPECs include body weight, food ingestion rate (FIR), drinking water ingestion rate (WIR), and dietary components and proportion of the overall diet represented by each major food type (P_i), including incidental ingestion of soil/sediment (P_s). The parameters are presented in Table 3-1.

  Wildlife at the site was considered to either have terrestrial- or aquatic-based exposures. The short-tailed shrew and American robin were considered for terrestrial-based exposures, consuming ground-dwelling invertebrates (such as earthworms and grasshoppers) and terrestrial vegetation. Belted kingfisher and mink were considered for aquatic-based exposures, consuming aquatic vegetation, benthic invertebrates, fish, and sediment, incidentally, which are predominately confined to the Lange and River Street canals. Aquatic- and terrestrial-based exposure designations were necessary for calculating EPCs, as described in the following bullet.

- **Exposure Point Concentrations**—Because wildlife are mobile, traveling and experiencing exposure over the range of habitats they occupy, their exposure is often described by site- or habitat-wide representation of the chemical data in areas they inhabit (Suter et al. 2000). For the BERA, the UCL was used as the basis of all abiotic media EPCs. ProUCL Version 5.0 was used to calculate the UCLs, and the ProUCL outputs are provided in Appendix A are for surface soil, sediment, surface water, and forage fish tissue residue. In some cases, a UCL could not be calculated. The EPCs for surface soil, sediment, surface water, forage fish tissue residue, and their basis are presented in Table 3-2.

- **Bioaccumulation—**Dietary items for which tissue concentrations of upper trophic level receptors were modeled included plants, invertebrates, and fish. The uptake of chemicals from the abiotic media was based upon mean literature-derived bioconcentration factors (BCFs) or bioaccumulation

[1] In most cases, dietary composition is reported on a wet-weight basis; however, proportions of dietary items used in this model are applied to dry-weight-based chemical data in tissue.

factors (BAFs) from the literature or log K_{ow}-based linear regression models. Terrestrial and aquatic BCFs, biota-sediment accumulation factors (BSAFs), and BAFs are presented in Table 3-3.

Available literature indicates that bioaccumulation is generally non-linear and often decreases as the medium concentration increases (Sample et al. 1999). When available and recommended for use in the primary literature, log-linear bioaccumulation regression models were used to more accurately estimate tissue concentrations in prey items (Table 3-3). This information is available in recent literature for Aroclors. Log-linear bioaccumulation regression models were used to estimate the uptake into plants, earthworms, and benthic invertebrates with the relationship as follows:

$$\ln (\text{Conc .COCprey}) = B0 + B1 (\ln [\text{Conc .COCsoil}])$$

Where:

Conc. COC_{prey}	=	concentration of chemical in plant, earthworm (mg chemical/kg dry weight)
B_0	=	slope (chemical-specific)
B_1	=	intercept (chemical-specific)
Conc. COC_{soil}	=	soil exposure point concentration (mg chemical/kg dry weight)

The fish BSAF is the overall mean of all whole body forage fish reported, in the EPA BSAF database, version 1.00 (EPA 2009). These BSAFs are tabulated in Appendix B.

SECTION 4

Effects Assessment

Section 4 consists of an evaluation of available toxicity or other effects information that was used to relate COPEC exposures to potential adverse effects in ecological receptors. The assessment, along with the exposure assessment (Section 3), corresponds to Step 2 of the 8-step ERA process for Superfund (EPA 1997). Effects data sources used to evaluate ecological risks resulting from exposure to contaminants included literature-derived and site-specific sources as discussed in the following subsections.

Three types of literature-derived single-chemical toxicity data were used in this SLERA. The data included abiotic medium-specific screening values for direct exposures to terrestrial plants (soil), soil invertebrates (soil), and aquatic biota (surface water and sediment); tissue residue-based screening values for direct exposures to forage fish; and ingestion screening values (dietary doses) for birds and mammals. Each type of effect data employed in the assessment is described in the following subsections.

4.1 Medium-Specific

Medium-specific effects data used in the SLERA consisted of soil invertebrate and terrestrial plant soil screening values, benthic invertebrate sediment screening values, and water-column biota surface water screening values derived from multiple sources. The screening values and sources are presented in Table 3-2.

4.2 Tissue Residue

A fish tissue residue-based screening value was used to evaluate forage fish from *Assessments of Chemical Mixtures via Toxicity Reference Values Overpredict Hazard to Ohio Fish Communities* (Dyer et al. 2000) (Table 3-2). The tissue benchmarks were derived as the product of EPA chronic aquatic life criteria and a BCF (Dyer et al. 2000) and have been demonstrated to define tissue residues lower than adverse effect residues in 95 percent of studies where adverse effects from bioaccumulated contaminants have been measured (Shephard 1998).

4.3 Ingestion

Ingestion screening values that represent dietary dose effect data for birds and mammals consisted of no observed adverse effect level (NOAEL) and lowest observed adverse effect level (LOAEL) toxicity reference values (TRVs) derived from toxicity studies reported in the scientific literature. Three types of TRVs were used for each in this assessment: NOAELs, LOAELs, and maximum allowable toxic concentrations (MATCs). MATC TRVs are the geometric mean of the NOAEL and LOAEL and is assumed to be the concentration at which effects are first seen. The TRVs are presented in Table 4-1. TRVs for wildlife receptors were selected to be consistent with PCB TRVs used at other Michigan sites contaminated with PCBs.

SECTION 5

Risk Characterization

The risk characterization portion of the SLERA integrates data presented in Sections 2 through 4 to estimate potential risks to ecological receptors for the exposure scenarios evaluated.

5.1 Screening Level Risk Evaluation

This section presents the results of the initial screening assessments. Risks in the vicinity of the TMD site were evaluated based on the ratio of exposure concentrations to screening values, resulting in HQs. The results of comparison of maximum media concentration to the screening values are presented in Table 5-1. The total PCB maximum concentrations in surface soil, sediment, surface water, and fish tissue residue exceeded the respective screening values by at least two orders of magnitude for each assessment endpoint.

5.2 Scientific Management Decision Point

Based on the Step 2 screening evaluation, the TMD site may pose an unacceptable risk to terrestrial and aquatic biota. Additional evaluation with a BERA is warranted to refine the risk estimates and reduce uncertainties.

SECTION 6

Baseline Ecological Risk Assessment

The SLERA identified PCBs as a COPEC and recommended that PCBs be carried forward to a BERA (Step 3 of the 8-step ERA process). The BERA begins with a refinement of the COPECs in which the conservative assumptions originally used in the SLERA are refined, and the risk estimates are recalculated using the same CSM. Additional lines of evidence also are addressed in a WOE approach as part of the refinement. This section presents an estimation of potential risk to ecological receptors in the TMD from direct and food-web exposures.

6.1 Refined Risk Characterization

In contrast to the conservative approach used for the initial screening level evaluation, the refined evaluation focuses on the biologically realistic potential for exposure and adverse effects to target species.

6.1.1 Direct Exposure

The potential for adverse effects to the terrestrial plant, soil invertebrate, benthic invertebrates, water-column biota, and fish communities was evaluated through a multi-parameter WOE approach. The potential for adverse effects to these communities was evaluated through this refined evaluation, which included frequencies of detection, the use of central tendency EPCs, secondary effects values comparisons, and frequency of exceedance (Table 6-1).

6.1.1.1 Frequency of Detection Evaluation

The frequency of detection of COPECs serves as an indicator of the extent of contamination across the study area. A low frequency of detection may indicate the contamination is limited to small portions of the site (hot spots) or even only in a single location where the sample was collected. If the contaminant was detected in 5 percent or fewer of all site samples, the chemical was not considered further as a COPEC. Total PCBs were detected in greater than 5 percent in all media and tissue residue.

6.1.1.2 Concentration-Based COPEC Refinement

The concentration-based COPEC refinement evaluated risk through direct contact with the surrounding medium using a central-tendency EPC rather than the maximum detected value. ProUCL Version 4.1 was used to calculate the UCLs. Total PCB EPCs were greater than the screening values for all lower trophic level assessment endpoints (Table 6-1).

To further define the potential for unacceptable risk, the frequency of exceedance may be considered. Exceedance of 20 percent or more of samples is considered strong evidence of unacceptable risk for those COPCs where the EPC was less than the ESV. However, the total PCB EPCs were greater than the screening values for all lower trophic level assessment endpoints; therefore, a frequency of exceedance evaluation was not necessary in the WOE evaluation.

The literature-derived screening values are considered conservative predictors of toxicity, and the exceedance of the screening levels may not indicate effects. While the EPCs for all of the remaining COPECs were greater than the conservative (lower threshold) screening levels, additional more realistic values were reviewed and considered as part of the WOE evaluation. The maximum concentrations were compared to these values (Table 6-1). The EPA Region 5 soil screening value (lower threshold) is based on effects to the shrew (EPA 2003). This overly conservative value, while useful in an initial screen, does not lend to accurate identification of final risk. Therefore, a more realistic screening value representative of potential plant effects from *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants* (Efroymson et al. 1997) was used in the refined comparison in soil. All total PCB soil concentrations in the residential area were below this value. The remaining medium-receptor combinations were carried into the risk description for additional consideration.

6.1.2 Food-Web Exposure

As discussed in Section 3.2, exposures for wildlife receptors were estimated through food-web modeling (dietary dose estimates) using site-specific abiotic media.

6.1.2.1 Terrestrial Wildlife

Estimated dietary doses of COPECs were compared to TRVs to evaluate the potential for adverse effects to wildlife that use the residential area. The following is a summary of the exposure estimates and screening results (Table 6-2):

- Mammalian vermivores—Short-tailed shrew: The estimated dose was above the NOAEL (HQ = 2.39) and MATC (HQ = 1.39) but below the LOAEL TRVs (HQ = 0.8).
- Avian omnivores—American robin: The estimated dose was below the NOAEL, MATC, and LOAEL TRVs.

The avian soil exposure pathway was eliminated from further consideration under the risk description.

6.1.2.2 Semiaquatic Wildlife

Estimated dietary doses of COPECs were compared to TRVs to evaluate the potential for adverse effects to wildlife receptors that use the Lange and Revere Street canals area. The following is a summary of the exposure estimates and screening results:

- Mammalian omnivores—Mink: The estimated dose exceeded the NOAEL and LOAEL TRVs.
- Avian omnivores—Belted kingfisher: The estimated dose exceeded the NOAEL and LOAEL TRVs.

The contaminant-exposure-receptor combinations were retained for further consideration under the risk description.

6.2 Risk Description

The estimates of risk from the various lines of evidence were combined with additional information for interpreting the risk results through a WOE process. For the risk description, risk estimates were put into context with a description of the extent, magnitude, and ecological significance of each line of evidence. In the following subsections, each line of evidence was evaluated and discussed for each assessment endpoint for direct exposure and food-web exposure routes. The outcome is a list of COPECs for soil, surface water, and sediment.

6.2.1 COPECs for Plants, Invertebrates, and Fish

Table 6-1 presents a summary of each line of evidence for each COPEC for terrestrial plants, invertebrates, and aquatic biota. In most samples, total PCB concentrations exceeded medium-based or tissue residue screening values. Unacceptable risk was indicated from all lines of evidence for total PCBs, based on potential adverse effects in water-column biota, including forage fish, and benthic invertebrate communities.

The WOE evaluation (Section 6.1.1) for residential area surface soil indicated no unacceptable risk for plant communities. Invertebrate risk could not be quantified based on limited total PCB toxicity data for invertebrates in soil. Invertebrates and plants are the most likely receptors to occur and be affected by soil contamination. Currently, available habitat consists of routinely mowed grass in the residential yards. Thus, the plant and invertebrate populations are and will be controlled by human activity. Although plant and invertebrate receptors are present at the site, the habitat does not represent a natural ecosystem. No further consideration is required for terrestrial plants and invertebrate communities in the residential soil area.

6.2.2 COPECs for Wildlife

The potential for adverse effects to wildlife were evaluated through desktop food web modeling that integrates site-specific abiotic media results in food items. A summary of the HQs for wildlife is presented in Table 6-2. For food-web exposure estimates, three categories of HQs were calculated (NOAEL-, MATC-, and LOAEL-based HQs). The NOAEL-based HQs compare estimated or measured exposure doses with levels expected to have no adverse effects, the MATC-based HQ compare the estimated dose to the concentration at which potential adverse effects may begin to be observed, and LOAEL-based HQs compare estimated or measured exposure doses with levels expected to have potentially adverse effects. The estimated dose for the short-tailed shrew slightly exceeds the NOAEL and the MATC. The MATC exceedance is slightly above one (HQ = 1.39). Given these low levels of exceedance and the conservative nature of the assessment, unacceptable risk to mammalian vermivore populations is unlikely. Therefore, no unacceptable risk is likely for terrestrial wildlife in the residential areas; however, semiaquatic wildlife populations may be affected by concentrations in surface water (drinking water) and sediment.

SECTION 7

Uncertainty

Uncertainties are inherent in all risk assessments. The nature and magnitude of the uncertainties depend on the amount and quality of data available, degree of knowledge concerning site conditions, and assumptions made to perform the assessment. As such, there are uncertainties with each line of evidence used in the SLERA. The following subsections summarize uncertainties by each line of evidence.

7.1 Chemical Analytical Results and Screening

7.1.1 Data Collection

Descriptions of the magnitude and distribution of COPCs within the site and the reference area are considered to be generally representative of current conditions. In spite of the overall confidence in exposure data, some data are clearly biased toward times of the year when sampling is easiest or most desirable. Surface soil samples were collected from a grid in an unbiased location, lessening the likelihood of skewing the data upwards. Other solid media data also may be biased toward sampling areas with a higher probability of contamination. This suggests that COPC concentrations taken to be representative of certain media may be biased upwards, resulting in overestimation of risks.

The 2010 MDEQ collection of the fish for fillet analysis may over- or under-estimate forage fish exposure. The fish collected were larger than what are typically considered forage fish. The size and feeding guild for these fish may have allowed for higher levels of total PCBs to accumulate in their systems, overestimating exposure. However, only the fillets (skin off and skin on) were analyzed. PCBs tend to accumulate in the structural fats (in cells, organs, etc.) of lean fish such as walleye, pike, bass, crappy, and bluegill and in the depolipids of fatty fish such as carp. Filleting these fish before analysis may under-estimate the PCB accumulation in the fat.

7.1.2 Undetected Contaminants

Several individual Aroclors were analyzed for and not detected in medium-specific samples. Because the contaminants were not detected, they are assumed to not be present in site-specific media.

7.2 Food-Web Exposure Modeling

7.2.1 Exposure Parameters

Uncertainty also is introduced into the food-web exposure model for wildlife receptors using literature-derived exposure parameters. Because these parameters (such as body weight, food and water ingestion rates, diet composition, etc.) may differ across the geographic range of a species or among individuals of the same species, the values used may not accurately represent individuals at the TMD site.

For dietary composition specifically, data from the *Wildlife Exposure Factors Handbook* (EPA 1993) was used to set most dietary proportions. The majority of these dietary composition data are reported on a wet-weight basis. As a result, there is an inconsistency between conducting food-web modeling using dry-weight medium-specific (soil, sediment, surface water, and/or tissue) contaminant concentrations, but estimating dietary composition on a wet-weight basis. The uncertainty introduced by this would be minimal for receptors modeled with sole source diets, or with dietary components with similar moisture contents (for example, mink [100 percent fish]), but there is greater uncertainty for receptors with a mix of dietary components with dissimilar moisture contents (for example, American robin eating plants and invertebrates). Ideally, weight-based dietary proportions would be converted to dry-weight proportions using moisture content data for each food category. However, sufficient data necessary to make such adjustments were not identified, and this uncertainty is noted.

7.2.2 Area Use Factors

Area use factors were assumed to equal 1. This is a conservative assumption since a significant percentage of each upper trophic level receptor species' time could be spent foraging offsite in unimpacted areas or in areas where chemical concentrations are expected to be significantly different.

7.2.3 Bioaccumulation

The bioaccumulation into aquatic plants and invertebrates was estimated using literature-based information. The uncertainties related to these approaches is briefly discussed in the following subsections.

7.2.3.1 Aquatic Plants

Because of the lack of information on uptake into aquatic plants in the scientific literature, site-specific BAFs calculated from terrestrial plant tissue and soil data also were used to represent aquatic plant bioaccumulation. Therefore, there is uncertainty associated with the use of terrestrial receptors representing aquatic plants. However, given the similarities in uptake routes in plants and the relative stability in terrestrial environments by soil, there is likely an overestimation of bioaccumulation.

7.2.3.2 Aquatic Invertebrates

The primary source of aquatic invertebrate BAFs were identified in the literature. Where reliable BAFs could not be identified in the literature, BAFs defaulted to 1 (100 percent bioaccumulation). Since the information does not include site-specific exposure information, there is uncertainty associated with it. However, bioaccumulation is intentionally conservative, likely overestimating bioaccumulation.

7.2.4 Toxicity Reference Values for Wildlife

Toxicity data were sparse or lacking for the selected receptor species, requiring the extrapolation of data from other wildlife species or from laboratory studies of non-wildlife species. This lack of data is a typical limitation for many wildlife species. When possible, however, the uncertainties associated with toxicity extrapolation were minimized through the careful selection of representative surrogate test species. The factors considered in selecting one species to represent another receptor species (or group of species) were taxonomic relatedness, trophic level, foraging method, and similarity of diet.

7.2.5 Hazard Quotients and Risk

The NOAEL-based HQs compare estimated exposure doses with levels expected to have no adverse effects, and LOAEL-based HQs compare estimated exposure doses with levels expected to have potentially adverse effects. By definition, the actual dose that is protective of an individual receptor falls between the NOAEL and LOAEL. Therefore, there is uncertainty with the risk evaluation for contaminants that yield a NOAEL-based HQ greater than 1 and LOAEL-based HQ below 1, because there is a possibility the lowest effect level is below the identified LOAEL TRV. Since that potentially lower effect level, if it exists, is below a level (identified LOAEL) that only has a potential to pose adverse affects itself, the uncertainty is low.

SECTION 8

Summary and Conclusions

The WOE evaluation presented in this SLERA identified that the sediment and surface water COPEC, total PCBs, requires consideration in the FS based on risk to semiaquatic wildlife populations, benthic invertebrate, and water-column biota communities, including forage fish.

Based on the WOE evaluation, total PCBs were not identified as presenting unacceptable ecological risk in upland terrestrial soils.

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Tables

Table 2-1. Threatened and Endangered Species for Macomb County, Michigan
Ecological Risk Assessment
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Listing	Source	Scientific Name	Common Name	Listed Status	Habitat[a]	Species or its habitat found at TMD site
Federal	United States Fish and Wildlife Service[a]	*Villosa fabalis*	Rayed Bean	E	Occurs in small, shallow rivers, in and near riffles and often near aquatic vegetation. It also occurs along shallow, wave-swept shores of lakes. This species is often buried deep in sand and/or gravel.	No
		Myotis sodalis	Indiana bat	E	Indiana bats roost and form maternity colonies under loose bark or in hollows and cavities of mature trees in the floodplain forest. In Michigan, savanna habitats adjacent to riparian corridors may have been historically important for roost sites, as the bats are thought to prefer sun-exposed trees for maximum warmth at the northern limit of their range. In winter, Indiana bats primarily hibernate in caves in Kentucky, Indiana, and Missouri, although a new hibernacula site has been found in northern Michigan at a hydroelectric facility.	No
State	Michigan Natural Features Inventory (as of 11/26/2013)[b]	*Alasmidonta viridis*	Slippershell	T	The slippershell mussel is typically found in creeks and headwaters of rivers, but has also been reported in larger rivers and in lakes (Clarke 1981). It usually occurs in sand or gravel substrate, butis occasionally found in mud (Clarke 1981). Suitable habitat for fish host species must be present.	No
		Acipenser fulvescens	Lake sturgeon	T	Lake sturgeon are generally benthic species and occur in large rivers and shallow areas of large lakes. They are most often associated with unvegetated deep run and pool habitats (>5ft) in rivers. In lakes, habitat use varies and depends on availability. Spawning often occurs in gravel bottom streams, but rocky, wave-swept lake shore and islands areas are also used when riverine habitats are unavailable.	No
		Agalinis gattingeri	Gattinger's gerardia	E	Annual forb (20-50 cm) of lakeplain prairies.	No
		Ammocrypta pellucida	Eastern sand darter	T	Found in streams and rivers with sandy substrates and lakes with sandy shoals. They are often found in slow moving waters where fine sand is deposited, often immediately downstream of a bend but can be found in faster waters.	No
		Armoracia lacustris	Lake cress	T	Quiet, shallow water up to approximately 7 dm in depth along lake margins, the backwaters of slow moving streams, bayous, and channels, and along inlets or outlets and stream mouths. It typically roots in silty, muddy, or sandy substrates.	No
		Asio otus	long-eared owl	T	Use many different forest communities for nest and roost sites but seem to be associated more closely with conifers than deciduous trees and occasionally use pine plantations. The proximity of these wooded areas to open grassy areas with abundant prey appears to be an important landscape feature.	No
		Buteo lineatus	Red-shouldered hawk	T	Will nest in a variety of habitats but seem to be closely associated with mature forests in or adjacent to wet meadows and swamps.	No
		Carex lupuliformis	False hop sedge	T	The few Michigan records supply little habitat information, noting that *C. lupuliformis* was collected from marshes, swamps, wet woods, shallow depressions in oak woods, swales, low wet ground, and vernal ponds in floodplains and other wooded wetlands.	No
		Clemmys guttata	Spotted turtle	T	Spotted turtles require clean, shallow, slow-moving bodies of water with muddy or mucky bottoms and some aquatic and emergent vegetation (Ernst et al. 1994, Harding 1997). Spotted turtles utilize a variety of shallow wetlands including shallow ponds, wet meadows, tamarack swamps, bogs, fens, sedge meadows, wet prairies, shallow cattail marshes, sphagnum seepages, small woodland streams and roadside ditches (Ernst et al. 1994, Harding 1997, Mauger pers. comm.). Although spotted turtles are considered fairly aquatic, they are frequently found on land in parts of its range and during certain times of the year (i.e., during the mating and nesting seasons and during the summer) (Ward et al. 1976). Terrestrial habitats in which spotted turtles are found include open fields and woodlands and along roads.	No
		Cyclonaias tuberculata	Purple wartyback	T	Found in medium to large rivers with gravel or mixed sand and gravel substrates.	No
		Epioblasma triquetra	Snuffbox mussel	E	The snuffbox mussel inhabits small and medium-sized rivers, although specimens have been taken from Lake Erie and large rivers, such as the St. Clair River.	No
		Epioblasma triquetra	Snuffbox	E	Inhabits sand, gravel, or cobble substrates in swift small and medium-sized rivers. Individuals are often buried deep in the sediment.	No
		Falco peregrinus	Peregrine falcon	E	historically nested on cliff faces but they have been introduced in several Michigan cities and are fairing quite well where they nest on many types of man-made structures and feed on the abundance of small city birds like Rock pigeons.	No
		Fraxinus profunda	Pumpkin ash	T	Found in floodplain forests in southern Lower Michigan, usually in lower bottoms. Also found in deciduous swamps.	No
		Galearis spectabilis	Showy orchis	T	primarily in rich deciduous woods, although vigorous woodland colonies are known to spread to more open habitat in Michigan, and in New England it is reported from hemlock forests (Case 1987). Showy orchis often occurs near temporary spring ponds in sandy clay or rich loam soils, or in the shadier and richer microhabitats.	No
		Gentiana puberulenta	Downy gentian	E	Found on edges of coastal plain marshes in oak barrens landscapes.	No
		Gentianella quinquefolia	Stiff gentian	T	Known from alkaline soils in marshy meadows, in mucky areas along river and stream banks, and wooded edges and hillsides.	No
		Hieracium paniculatum	Panicled hawkweed	T	The habitat for this species is poorly known, but it has been associated with sandy oak woods, particularly on old dunes.	No
		Hiodon tergisus	Mooneye	T	Occurs in clear large rivers and lakes. They are often found in deep holes of rivers with swift currents and firm substrates. In the Great Lakes they often occur within 1 mile of shoreline and are absent at depths below 10 m.	No
		Hydrastis canadensis	Goldenseal	T	Found in southern hardwood forests, as well as moist ravines and portions of riparian forests.	No
		Lampsilis fasciola	Wavyrayed lampmuss	T	Occurs in small-medium sized shallow streams, in and near riffles, with good current. It rarely occurs in medium rivers. The substrate preference is sand and/or gravel.	No
		Ligumia nasuta	Eastern pond mussel	E	Preferring fine sand to mud substrates, the Eastern pond mussel inhabits lakes and ponds, as well as slackwater areas of canals, rivers and streams.	No
		Ligumia recta	Black sandshell	E	Most commonly occupies rivers with strong currents and lakes with a firm substrate of gravel or sand.	No
		Linum virginianum	Virginia flax	T	Found in open oak forests, upland woods, dry and mesic lakeside and riparian forests in the southern Lower Peninsula.	No
		Notropis anogenus	Pugnose shiner	E	Inhabits clear vegetated lakes and vegetated pools and runs of low gradient streams and rivers. They appear to be extremely intolerant to turbidity.	No
		Obovaria olivaria	Hickorynut	E	The Hickorynut is found in large rivers and lakes in sand or sand and gravel substrates.	No
		Obovaria subrotunda	Round hickorynut	E	Typically found in medium to large rivers and along the shores of Lake Erie and Lake St. Clair, near river mouths. The round hickorynut generally is found in sand and gravel substrates in areas with moderate flow.	No
		Pantherophis gloydi	Eastern fox snake	T	Inhabits emergent wetlands along Great Lakes shorelines and associated large rivers and impoundments. They prefer habitats with herbaceous vegetation such as cattails (Typha spp.). Although primarily an open wetland species, Eastern Fox Snakes also occupy drier habitats such as vegetated dunes and beaches, old fields, and open woodlands. They also are able to utilize disturbed areas such as farm fields, pastures, woodlots, vacant urban lots, rock riprap, ditches, dikes, and residential properties. Eastern Fox Snakes are usually found near water, and are capable of swimming long distances over open offshore waters and between islands. This species deposits its eggs in or under the soil, woody debris, sawdust piles, decaying vegetation and mammal burrows, and hibernates in abandoned mammal burrows, muskrat lodges or other suitable shelters.	No
		Percina copelandi	Channel darter	E	Inhabits rivers and large creeks in areas of moderate current over sand and gravel substrates. It also occurs in wave swept nearshore areas of lakes Huron and Erie in coarse-sand, fine-gravel beach and sandbar habitats.	No
		Percina shumardi	River darter	E	Occurs in rivers and large streams, preferring deep, fast-flowing riffles with cobble and boulder substrates. Adults typically occur in shallow areas at night or when turbidity is high. They also occur in nearshore areas of the Great Lakes at depths around 5 m. This species is fairly tolerant to turbidity.	No
		Plantago cordata	Heart-leaved plantain	E	Heart-leaved plantain occurs in large river floodplains and along small, mucky streams.	No
		Platanthera ciliaris	Orange- or yellow-fringed orchid	E	Found in acidic swamps dominated by bog vegetation.	No
		Rallus elegans	King rail	E	Bird of coastal wetlands in the Great Lakes region. They are associated with permanent marsh habitats along upland-wetland edges largely dominated by tussock-forming sedges. In Michigan, we have few confirmed breeding records for this species in the last decade.	No
		Silphium integrifolium	Rosinweed	T	Stout forb (1.5 m) of moist to dry-mesic prairies. Occurs in prairie remnants along roads and railroad tracks or in cemeteries, in wet-mesic prairies and fens on peaty mucks and loams, and on dry-mesic to mesic loams and sandy loams.	No
		Sterna forsteri	Forster's tern	T	Nest far from shore within marshes to avoid many predators. They may use muskrat lodges or floating rack as a base to support the nest.	No
		Sterna hirundo	Common tern	T	Typically nest on islands to avoid many terrestrial predators.	No
		Toxolasma parvus	Lilliput	E	Most commonly occurs in creeks with mud or clay substrates, but can also be found in rivers, lakes, and impoundments.	No

Notes:
[a]Habitat descriptions collected from information provided at: http://mnfi.anr.msu.edu/data/specialanimals.cfm/ and http://mnfi.anr.msu.edu/data/specialplants.cfm.
E - endangered
T - threatened
1 - http://ecos.fws.gov/tess_public/; accessed 02/18/14
2 -http://mnfi.anr.msu.edu/data/county.cfm; accessed 02/18/14

Table 2-2. Assessment Endpoints, Level of Biological Organization, Measurement Endpoints, and Representative Receptors
Ecological Risk Assessment
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Assessment Endpoint	Level of Biological Organization	Measurement Endpoint	Receptor
Terrestrial Habitats			
Survival, growth, and reproduction of terrestrial plant communities	Lower trophic level	Comparison of media concentrations to direct exposure screening values	Terrestrial plants
Survival, growth, and reproduction of terrestrial soil invertebrate communities			Soil invertebrates
Survival, growth, and reproduction of terrestrial mammalian vermivore populations			Short-tailed shrew
Survival, growth, and reproduction of terrestrial avian omnivore populations			American robin
Aquatic Habitats			
Survival, growth, and reproduction of fish, aquatic plant, and benthic invertebrate communities	Lower trophic level	Comparison of media concentrations to direct exposure screening values	Fish
			Benthic invertebrate community
			Aquatic plant community
Survival, growth, and reproduction of aquatic mammalian omnivore populations	Upper trophic level	Comparison of modeled dietary intakes using sediment concentrations with literature-based ingestion screening values	Mink
Survival, growth, and reproduction of aquatic avian omnivore populations			Belted kingfisher

Notes:
The mourning dove dietary intake will be compared to ingestion screening values based upon a no-observed -adverse-effect-levels

Table 2-3. Residential Area Surface Soil (0-3') Analytical Dataset for ERA
Ecological Risk Assessment
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Station ID	TMD-003	TMD-003	TMD-003	TMD-004	TMD-004	TMD-004	TMD-005	TMD-005	TMD-005	TMD-005	TMD-006	TMD-006	TMD-006	TMD-007	TMD-007	TMD-007	TMD-008	TMD-008	TMD-008	TMD-009	TMD-009	TMD-009	TMD-010	TMD-010	TMD-010
Sample ID	TMD-SO-003-0/0.5	TMD-SO-003-1/1.5	TMD-SO-003-2.5/3	TMD-SO-004-0/0.5	TMD-SO-004-1/1.5	TMD-SO-004-2.5/3	TMD-SO-005-0.5/1	TMD-SO-005-0/0.5	TMD-SO-005-1/1.5	TMD-SO-005-2.5/3	TMD-SO-006-0/0.5	TMD-SO-006-1/1.5	TMD-SO-006-2.5/3	TMD-SO-007-0/0.5	TMD-SO-007-1/1.5	TMD-SO-007-2.5/3	TMD-SO-008-0/0.5	TMD-SO-008-1/1.5	TMD-SO-008-2.5/3	TMD-SO-009-0/0.5	TMD-SO-009-1/1.5	TMD-SO-009-2.5/3	TMD-SO-010-0/0.5R1	TMD-SO-010-0/0.5R2	TMD-SO-010-0/0.5R3
Date Collected	4/30/2013	4/30/2013	4/30/2013	4/30/2013	4/30/2013	4/30/2013	5/2/2013	4/30/2013	4/30/2013	4/30/2013	5/1/2013	5/1/2013	5/1/2013	5/1/2013	5/1/2013	5/1/2013	5/1/2013	5/1/2013	5/1/2013	5/2/2013	5/2/2013	5/2/2013	5/2/2013	5/2/2013	5/2/2013
Depth	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0.5 - 1	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	0 - 0.5	0 - 0.5
Analyte (µg/kg)																									
Aroclor-1016	420 U	390 U	380 U	390 U	390 U	380 U	20.8 U	380 U	390 U	390 U	20.9 U	380 U	390 U	360 U	370 U	360 U	380 U	400 U	380 U	420 U	20.7 U	440 U	400 U	400 U	410 U
Aroclor-1221							20.8 U				20.9 U										20.7 U				
Aroclor-1232	420 U	390 U	380 U	390 U	390 U	380 U	20.8 U	380 U	390 U	390 U	20.9 U	380 U	390 U	360 U	370 U	360 U	380 U	400 U	380 U	420 U	20.7 U	440 U	400 U	400 U	410 U
Aroclor-1242	420 U	390 U	380 U	390 U	390 U	380 U	20.8 U	380 U	390 U	390 U	20.9 U	380 U	390 U	360 U	370 U	360 U	380 U	400 U	380 U	420 U	20.7 U	440 U	400 U	400 U	410 U
Aroclor-1248	420 U	390 U	380 U	390 U	390 U	380 U	650	1300	390 U	390 U	20.9 U	380 U	390 U	360 U	370 U	360 U	380 U	400 U	380 U	370 J	20.7 U	440 U	1600	1200	2100
Aroclor-1254	420 U	390 U	380 U	390 U	390 U	380 U	20.8 U	380 U	390 U	390 U	20.9 U	380 U	390 U	360 U	370 U	360 U	380 U	400 U	380 U	420 U	20.7 U	440 U	400 U	400 U	410 U
Aroclor-1260	420 U	390 U	380 U	390 U	390 U	380 U	20.8 U	380 U	390 U	390 U	20.9 U	380 U	390 U	360 U	370 U	360 U	380 U	400 U	380 U	420 U	20.7 U	440 U	400 U	400 U	410 U
Aroclor-1262							20.8 U				20.9 U										20.7 U				
Aroclor-1268							20.8 U				20.9 U										20.7 U				
Total PCBs	420 U	390 U	380 U	390 U	390 U	380 U	660.4	1490	390 U	390 U	20.9 U	380 U	390 U	360 U	370 U	360 U	380 U	400 U	380 U	580	20.7 U	440 U	1800	1400	2305

Station ID	TMD-010	TMD-010	TMD-010	TMD-010	TMD-010	TMD-010	TMD-010	TMD-011	TMD-011	TMD-011	TMD-011	TMD-011	TMD-011	TMD-011	TMD-011	TMD-011	TMD-011	TMD-011	TMD-011	TMD-012	TMD-012	TMD-012	TMD-013	TMD-013	TMD-013
Sample ID	TMD-SO-010-1/1.5R1	TMD-SO-010-1/1.5R2	TMD-SO-010-1/1.5R3	TMD-SO-010-2.5/3R1	TMD-SO-010-2.5/3R2	TMD-SO-010-2.5/3R3	TMD-SO-010-2/2.5-R3	TMD-SO-011-0.5/1	TMD-SO-011-0.5/1R2	TMD-SO-011-0.5/1R3	TMD-SO-011-0/0.5/R3	TMD-SO-011-0/0.5R1	TMD-SO-011-0/0.5R2	TMD-SO-011-1/1.5R1	TMD-SO-011-1/1.5R2	TMD-SO-011-1/1.5R3	TMD-SO-011-2.5/3R1	TMD-SO-011-2.5/3R2	TMD-SO-011-2.5/3R3	TMD-SO-012-0/0.5	TMD-SO-012-1/1.5	TMD-SO-012-2.5/3	TMD-SO-013-0/0.5	TMD-SO-013-1/1.5	TMD-SO-013-2.5/3
Date Collected	5/2/2013	5/3/2013	5/3/2013	5/3/2013	5/6/2013	5/9/2013	5/6/2013	5/15/2013	5/15/2013	5/15/2013	5/6/2013	5/6/2013	5/6/2013	5/6/2013	5/6/2013	5/6/2013	5/6/2013	5/6/2013	5/8/2013	5/8/2013	5/8/2013	5/8/2013	5/8/2013	5/9/2013	5/9/2013
Depth	1 - 1.5	1 - 1.5	1 - 1.5	2.5 - 3	2.5 - 3	2.5 - 3	2 - 2.5	0.5 - 1	0.5 - 1	0.5 - 1	0 - 0.5	0 - 0.5	0 - 0.5	1 - 1.5	1 - 1.5	1 - 1.5	2.5 - 3	2.5 - 3	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3
Analyte (µg/kg)																									
Aroclor-1016	390 U	390 U	390 U	380 U	400 U	380 U	390 U	370 U	390 U	370 U	410 U	400 U	380 U	380 U	360 U	340 U	370 U	400 U	19.8 U	370 U	380 U	350 U	390 U	350 U	350 U
Aroclor-1221																			19.8 U						
Aroclor-1232	390 U	390 U	390 U	380 U	400 U	380 U	390 U	370 U	390 U	370 U	410 U	400 U	380 U	380 U	360 U	340 U	370 U	400 U	19.8 U	370 U	380 U	350 U	390 U	350 U	350 U
Aroclor-1242	390 U	390 U	390 U	380 U	400 U	380 U	390 U	370 U	390 U	370 U	410 U	400 U	380 U	380 U	360 U	340 U	370 U	400 U	19.8 U	370 U	380 U	350 U	390 U	350 U	350 U
Aroclor-1248	310 J	270 J	270 J	380 U	400 U	210 J	210 J	1700	1700	1600	2900	2300	2300	380	630	960	280 J	470	19.8 U	370 U	380 U	350 U	640	350 U	550
Aroclor-1254	390 U	390 U	390 U	380 U	400 U	380 U	390 U	370 U	390 U	370 U	410 U	400 U	380 U	380 U	360 U	340 U	370 U	400 U	19.8 U	370 U	380 U	350 U	390 U	350 U	350 U
Aroclor-1260	390 U	390 U	390 U	380 U	400 U	380 U	390 U	370 U	390 U	370 U	410 U	400 U	380 U	380 U	360 U	340 U	370 U	400 U	19.8 U	370 U	380 U	350 U	390 U	350 U	350 U
Aroclor-1262																			19.8 U						
Aroclor-1268																			19.8 U						
Total PCBs	505	465	465	380 U	400 U	400	405	1885	1895	1785	3105	2500	2490	570	810	1130	465	670	19.8 U	370 U	380 U	350 U	835	350 U	725

Station ID	TMD-014	TMD-014	TMD-014	TMD-015	TMD-015	TMD-015	TMD-016	TMD-016	TMD-016	TMD-016	TMD-017	TMD-017	TMD-017	TMD-018	TMD-018	TMD-018	TMD-019	TMD-019	TMD-019	TMD-019	TMD-019	TMD-019	TMD-019	TMD-019	TMD-020
Sample ID	TMD-SO-014-0/0.5	TMD-SO-014-1/1.5	TMD-SO-014-2.5/3	TMD-SO-015-0/0.5	TMD-SO-015-1/1.5	TMD-SO-015-2.5/3	TMD-SO-016-0/0.5	TMD-SO-016-1.5/2	TMD-SO-016-1/1.5	TMD-SO-016-2.5/3	TMD-SO-017-0/0.5	TMD-SO-017-1/1.5	TMD-SO-017-2.5/3	TMD-SO-018-0/0.5	TMD-SO-018-1/1.5	TMD-SO-018-2.5/3	TMD-SO-019-0/0.5R1	TMD-SO-019-0/0.5R2	TMD-SO-019-0/0.5R3	TMD-SO-019-1/1.5R1	TMD-SO-019-1/1.5R2	TMD-SO-019-1/1.5R3	TMD-SO-019-2.5/3R2	TMD-SO-019-2.5/3R3	TMD-SO-020-0/0.5
Date Collected	5/9/2013	5/9/2013	5/9/2013	5/9/2013	5/9/2013	5/9/2013	5/9/2013	5/15/2013	5/9/2013	5/9/2013	5/10/2013	5/10/2013	5/10/2013	5/10/2013	5/13/2013	5/13/2013	5/13/2013	5/13/2013	5/13/2013	5/13/2013	5/13/2013	5/13/2013	5/13/2013	5/13/2013	5/13/2013
Depth	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1.5 - 2	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	1 - 1.5	2.5 - 3	1 - 1.5	2.5 - 3	0 - 0.5	0 - 0.5	0 - 0.5	1 - 1.5	1 - 1.5	1 - 1.5	2.5 - 3	2.5 - 3	0 - 0.5
Analyte (µg/kg)																									
Aroclor-1016	420 U	410 U	390 U	20.4 U	360 U	340 U	300 U	380 U	340 U	380 U	380 U	390 U	420 U	360 U	19.8 U	390 U	380 U	360 U	19.6 U	390 U	380 U	380 U	380 U	410 U	360 U
Aroclor-1221				20.4 U											19.8 U				19.6 U						
Aroclor-1232	420 U	410 U	390 U	20.4 U	360 U	340 U	300 U	380 U	340 U	380 U	380 U	390 U	420 U	360 U	19.8 U	390 U	380 U	360 U	19.6 U	390 U	380 U	380 U	380 U	410 U	360 U
Aroclor-1242	420 U	410 U	390 U	20.4 U	360 U	340 U	300 U	380 U	340 U	380 U	380 U	390 U	420 U	360 U	19.8 U	390 U	380 U	360 U	19.6 U	390 U	380 U	380 U	380 U	410 U	360 U
Aroclor-1248	420 U	410 U	390 U	1600	360 U	340 U	240 J	380 U	3300	380 U	380 U	390 U	420 U	360 U	19.8 U	390 U	1000	1700	1400	340 J	370 J	620	230 J	410 U	180 J
Aroclor-1254	420 U	410 U	390 U	20.4 U	360 U	340 U	300 U	380 U	340 U	380 U	380 U	390 U	420 U	360 U	19.8 U	390 U	380 U	360 U	19.6 U	390 U	380 U	380 U	380 U	410 U	360 U
Aroclor-1260	420 U	410 U	390 U	20.4 U	360 U	340 U	300 U	380 U	340 U	380 U	380 U	390 U	420 U	360 U	19.8 U	390 U	380 U	360 U	19.6 U	390 U	380 U	380 U	380 U	410 U	360 U
Aroclor-1262				20.4 U											19.8 U				19.6 U						
Aroclor-1268				20.4 U											19.8 U				19.6 U						
Total PCBs	420 U	410 U	390 U	1610.2	360 U	340 U	390	380 U	3470	380 U	380 U	390 U	420 U	360 U	19.8 U	390 U	1190	1880	1409.8	535	560	810	420	410 U	360

Table 2-3. Residential Area Surface Soil (0-3') Analytical Dataset for ERA
Ecological Risk Assessment
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Station ID	**TMD-020**	**TMD-020**	**TMD-020**	**TMD-021**	**TMD-021**	**TMD-021**	**TMD-022**	**TMD-022**	**TMD-022**	**TMD-023**	**TMD-023**	**TMD-023**	**TMD-024**	**TMD-024**	**TMD-024**	**TMD-025**	**TMD-025**	**TMD-025**	**TMD-026**	**TMD-026**	**TMD-026**	**TMD-027**	**TMD-027**	**TMD-027**	**TMD-028**
Sample ID	**TMD-SO-020-1/1.5**	**TMD-SO-020-2.5/3**	**TMD-SO-020-2.5/3R1**	**TMD-SO-021-0/0.5**	**TMD-SO-021-1/1.5**	**TMD-SO-021-2.5/3**	**TMD-SO-022-0/0.5**	**TMD-SO-022-1/1.5**	**TMD-SO-022-2.5/3**	**TMD-SO-023-0/0.5**	**TMD-SO-023-1/1.5**	**TMD-SO-023-2.5/3**	**TMD-SO-024-0/0.5**	**TMD-SO-024-1/1.5**	**TMD-SO-024-2.5/3**	**TMD-SO-025-0/0.5**	**TMD-SO-025-1/1.5**	**TMD-SO-025-2.5/3**	**TMD-SO-026-0/0.5**	**TMD-SO-026-1/1.5**	**TMD-SO-026-2.5/3**	**TMD-SO-027-0/0.5**	**TMD-SO-027-1/1.5**	**TMD-SO-027-2.5/3**	**TMD-SO-028-0/0.5R1**
Date Collected	**5/13/2013**	**5/14/2013**	**5/13/2013**	**5/14/2013**	**5/15/2013**	**5/15/2013**	**5/15/2013**	**5/15/2013**	**5/15/2013**	**5/15/2013**	**5/15/2013**	**5/15/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**
Depth	**1 - 1.5**	**2.5 - 3**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**
Analyte (µg/kg)																									
Aroclor-1016	360 U	390 U	370 U	400 U	20.2 U	380 U	360 U	360 U	400 UJ	390 U	19.7 U	380 U	330 U	370 U	400 U	380 U	370 U	410 U	430 U	20.9 U	370 U	380 U	360 U	410 UJ	360 U
Aroclor-1221					20.2 U						19.7 U									20.9 U					
Aroclor-1232	360 U	390 U	370 U	400 U	20.2 U	380 U	360 U	360 U	400 UJ	390 U	19.7 U	380 U	330 U	370 U	400 U	380 U	370 U	410 U	430 U	20.9 U	370 U	380 U	360 U	410 UJ	360 U
Aroclor-1242	360 U	390 U	370 U	400 U	20.2 U	380 U	360 U	360 U	400 UJ	390 U	19.7 U	380 U	330 U	370 U	400 U	380 U	370 U	410 U	430 U	20.9 U	370 U	380 U	360 U	410 UJ	360 U
Aroclor-1248	500	390 U	370 U	400 U	20.2 U	380 U	360 U	1200	400 UJ	290 J	116	300 J	820	440	400 U	1700	350 J	310 J	1600	490	510	440	570	410 UJ	360 U
Aroclor-1254	360 U	390 U	370 U	400 U	20.2 U	380 U	360 U	360 U	400 UJ	390 U	19.7 U	380 U	330 U	370 U	400 U	380 U	370 U	410 U	430 U	20.9 U	370 U	380 U	360 U	410 UJ	360 U
Aroclor-1260	360 U	390 U	370 U	400 U	20.2 U	380 U	360 U	360 U	400 UJ	390 U	19.7 U	380 U	330 U	370 U	400 U	380 U	370 U	410 U	430 U	20.9 U	370 U	380 U	360 U	410 UJ	360 U
Aroclor-1262					20.2 U						19.7 U									20.9 U					
Aroclor-1268					20.2 U						19.7 U									20.9 U					
Total PCBs	680	390 U	370 U	400 U	20.2 U	380 U	360 U	1380	400 U	485	125.85	490	985	625	400 U	1890	535	515	1815	500.45	695	630	750	410 U	360 U

Station ID	**TMD-028**	**TMD-028**	**TMD-028**	**TMD-028**	**TMD-028**	**TMD-028**	**TMD-028**	**TMD-028**	**TMD-029**	**TMD-029**	**TMD-029**	**TMD-030**	**TMD-030**	**TMD-030**	**TMD-031**	**TMD-031**	**TMD-031**	**TMD-032**	**TMD-032**	**TMD-032**	**TMD-033**	**TMD-033**	**TMD-033**	**TMD-033**	**TMD-034**
Sample ID	**TMD-SO-028-0/0.5R2**	**TMD-SO-028-0/0.5R3**	**TMD-SO-028-1/1.5R1**	**TMD-SO-028-1/1.5R2**	**TMD-SO-028-1/1.5R3**	**TMD-SO-028-2.5/3R1**	**TMD-SO-028-2.5/3R2**	**TMD-SO-028-2.5/3R3**	**TMD-SO-029-0/0.5**	**TMD-SO-029-1/1.5**	**TMD-SO-029-2.5/3**	**TMD-SO-030-0/0.5**	**TMD-SO-030-1/1.5**	**TMD-SO-030-2.5/3**	**TMD-SO-031-0/0.5**	**TMD-SO-031-1/1.5**	**TMD-SO-031-2.5/3**	**TMD-SO-032-0/0.5**	**TMD-SO-032-1/1.5**	**TMD-SO-032-2.5/3**	**TMD-SO-033-0.5/1**	**TMD-SO-033-0/0.5**	**TMD-SO-033-1/1.5**	**TMD-SO-033-2.5/3**	**TMD-SO-034-0/0.5**
Date Collected	**5/17/2013**	**5/17/2013**	**5/16/2013**	**5/17/2013**	**5/17/2013**	**5/17/2013**	**5/17/2013**	**5/17/2013**	**5/16/2013**	**5/16/2013**	**5/16/2013**	**5/17/2013**	**5/17/2013**	**5/20/2013**	**5/20/2013**	**5/20/2013**	**5/20/2013**	**5/20/2013**	**5/20/2013**	**5/20/2013**	**5/21/2013**	**5/20/2013**	**5/20/2013**	**5/20/2013**	**5/20/2013**
Depth	**0 - 0.5**	**0 - 0.5**	**1 - 1.5**	**1 - 1.5**	**1 - 1.5**	**2.5 - 3**	**2.5 - 3**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 3.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0.5 - 1**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**
Analyte (µg/kg)																									
Aroclor-1016	360 U	350 U	380 U	19.9 U	350 U	400 U	400 U	290 U	330 U	360 U	390 U	19.9 U	390 U	400 U	320 U	300 U	390 U	330 U	330 U	340 U	340 U	21.2 U	300 U	220 U	300 U
Aroclor-1221				19.9 U								19.9 U										21.2 U			
Aroclor-1232	360 U	350 U	380 U	19.9 U	350 U	400 U	400 U	290 U	330 U	360 U	390 U	19.9 U	390 U	400 U	320 U	300 U	390 U	330 U	330 U	340 U	340 U	21.2 U	300 U	220 U	300 U
Aroclor-1242	360 U	350 U	380 U	19.9 U	350 U	400 U	400 U	290 U	330 U	360 U	390 U	19.9 U	390 U	400 U	320 U	300 U	390 U	330 U	330 U	340 U	340 U	21.2 U	300 U	220 U	300 U
Aroclor-1248	360 U	350 U	380 U	19.9 U	350 U	400 U	400 U	290 U	1700	900	390 J	19.9 U	390 U	400 U	330	230 J	530	1200	330 U	240 J	340 U	2900	530	340	200 J
Aroclor-1254	360 U	350 U	380 U	19.9 U	350 U	400 U	400 U	290 U	330 U	360 U	390 U	19.9 U	390 U	400 U	320 U	300 U	390 U	330 U	330 U	340 U	340 U	21.2 U	300 U	220 U	300 U
Aroclor-1260	360 U	350 U	380 U	19.9 U	350 U	400 U	400 U	290 U	330 U	360 U	390 U	19.9 U	390 U	400 U	320 U	300 U	390 U	330 U	330 U	340 U	340 U	21.2 U	300 U	220 U	300 U
Aroclor-1262				19.9 U								19.9 U										21.2 U			
Aroclor-1268				19.9 U								19.9 U										21.2 U			
Total PCBs	360 U	350 U	380 U	19.9 U	350 U	400 U	400 U	290 U	1865	1080	585	19.9 U	390 U	400 U	490	380	725	1365	330 U	410	340 U	2910.6	680	450	350

Station ID	**TMD-034**	**TMD-034**	**TMD-035**	**TMD-035**	**TMD-035**	**TMD-036**	**TMD-036**	**TMD-036**	**TMD-037**	**TMD-037**	**TMD-037**	**TMD-038**	**TMD-038**	**TMD-038**	**TMD-039**	**TMD-039**	**TMD-039**	**TMD-040**	**TMD-040**	**TMD-040**	**TMD-040**	**TMD-040**	**TMD-040**	**TMD-040**	**TMD-040**
Sample ID	**TMD-SO-034-1/1.5**	**TMD-SO-034-2.5/3**	**TMD-SO-035-0/0.5**	**TMD-SO-035-1/1.5**	**TMD-SO-035-2.5/3**	**TMD-SO-036-0/0.5**	**TMD-SO-036-1/1.5**	**TMD-SO-036-2.5/3**	**TMD-SO-037-0/0.5**	**TMD-SO-037-1/1.5**	**TMD-SO-037-2.5/3**	**TMD-SO-038-0/0.5**	**TMD-SO-038-1/1.5**	**TMD-SO-038-2.5/3**	**TMD-SO-039-0/0.5**	**TMD-SO-039-1/1.5**	**TMD-SO-039-2.5/3**	**TMD-SO-040-0/0.5R1**	**TMD-SO-040-0/0.5R2**	**TMD-SO-040-0/0.5R3**	**TMD-SO-040-1/1.5R1**	**TMD-SO-040-1/1.5R2**	**TMD-SO-040-1/1.5R3**	**TMD-SO-040-2.5/3R1**	**TMD-SO-040-2.5/3R2**
Date Collected	**5/20/2013**	**5/20/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/21/2013**	**5/22/2013**	**5/22/2013**	**5/22/2013**	**5/22/2013**	**5/22/2013**	**5/22/2013**	**5/22/2013**	**5/22/2013**	**5/22/2013**	**5/22/2013**
Depth	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**1 - 1.5**	**2.5 - 3**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**1 - 1.5**	**1 - 1.5**	**1 - 1.5**	**2.5 - 3**	**2.5 - 3**
Analyte (µg/kg)																									
Aroclor-1016	300 U	320 U	400 U	340 U	280 U	20.2 U	360 U	400 U	380 U	300 U	260 U	370 U	330 U	370 U	19.8 U	350 U	340 U	290 U	330 U	19.6 U	340 U	390 U	300 U	320 U	370 U
Aroclor-1221						20.2 U									19.8 U					19.6 U					
Aroclor-1232	300 U	320 U	400 U	340 U	280 U	20.2 U	360 U	400 U	380 U	300 U	260 U	370 U	330 U	370 U	19.8 U	350 U	340 U	290 U	330 U	19.6 U	340 U	390 U	300 U	320 U	370 U
Aroclor-1242	300 U	320 U	400 U	340 U	280 U	20.2 U	360 U	400 U	380 U	300 U	260 U	370 U	330 U	370 U	19.8 U	350 U	340 U	290 U	330 U	19.6 U	340 U	390 U	300 U	320 U	370 U
Aroclor-1248	300 U	320 U	400 U	340 U	280 U	20.2 U	880	210 J	380 U	300 U	260 U	520	330 U	370 U	430	350 U	340 U	290 U	330 U	19.6 U	340 U	390 U	300 U	320 U	370 U
Aroclor-1254	300 U	320 U	400 U	340 U	280 U	20.2 U	360 U	400 U	380 U	300 U	260 U	370 U	330 U	370 U	19.8 U	350 U	340 U	290 U	330 U	19.6 U	340 U	390 U	300 U	320 U	370 U
Aroclor-1260	300 U	320 U	400 U	340 U	280 U	20.2 U	360 U	400 U	380 U	300 U	260 U	370 U	330 U	370 U	19.8 U	350 U	340 U	290 U	330 U	19.6 U	340 U	390 U	300 U	320 U	370 U
Aroclor-1262						20.2 U									19.8 U					19.6 U					
Aroclor-1268						20.2 U									19.8 U					19.6 U					
Total PCBs	300 U	320 U	400 U	340 U	280 U	20.2 U	1060	410	380 U	300 U	260 U	705	330 U	370 U	439.9	350 U	340 U	290 U	330 U	19.6 U	340 U	390 U	300 U	320 U	370 U

Table 2-3. Residential Area Surface Soil (0-3') Analytical Dataset for ERA

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Station ID	TMD-040	TMD-041	TMD-041	TMD-041	TMD-041	TMD-041	TMD-041	TMD-041	TMD-041	TMD-041	TMD-043	TMD-043	TMD-043	TMD-044	TMD-044	TMD-044	TMD-045	TMD-045	TMD-046	TMD-046	TMD-047	TMD-047	TMD-047	TMD-049	TMD-049
Sample ID	2.5/3R3	0/0.5R1	0/0.5R2	0/0.5R3	1/1.5R1	1/1.5R2	1/1.5R3	2.5/3R1	2.5/3R2	2.5/3R3	0/0.5	1.5/2	1/1.5	0/0.5	1.5/2	1/1.5	0/0.5	1/1.5	0/0.5	1/1.5	0/0.5	1.5/2	1/1.5	0/0.5	1.5/2
Date Collected	5/22/2013	5/22/2013	5/22/2013	5/23/2013	5/22/2013	5/23/2013	5/23/2013	5/22/2013	5/22/2013	5/23/2013	6/4/2013	6/5/2013	6/4/2013	6/5/2013	6/6/2013	6/5/2013	6/5/2013	6/5/2013	6/5/2013	6/5/2013	6/5/2013	6/6/2013	6/5/2013	6/6/2013	6/7/2013
Depth	2.5 - 3	0 - 0.5	0 - 0.5	0 - 0.5	1 - 1.5	1 - 1.5	1 - 1.5	2.5 - 3	2.5 - 3	2.5 - 3	0 - 0.5	1.5 - 2	1 - 1.5	0 - 0.5	1.5 - 2	1 - 1.5	0 - 0.5	1 - 1.5	0 - 0.5	1 - 1.5	0 - 0.5	1.5 - 2	1 - 1.5	0 - 0.5	1.5 - 2
Analyte (µg/kg)																									
Aroclor-1016	350 U	320 U	350 U	20.2 U	380 U	330 U	330 U	380 U	340 U	370 U	360 U	380 U	380 U	360 U	330 U	360 U	104 U	390 U	410 U	390 U	360 U	410 U	400 U	390 U	98.2 U
Aroclor-1221				20.2 U													104 U								98.2 U
Aroclor-1232	350 U	320 U	350 U	20.2 U	380 U	330 U	330 U	380 U	340 U	370 U	360 U	380 U	380 U	360 U	330 U	360 U	104 U	390 U	410 U	390 U	360 U	410 U	400 U	390 U	98.2 U
Aroclor-1242	350 U	320 U	350 U	20.2 U	380 U	330 U	330 U	380 U	340 U	370 U	360 U	380 U	380 U	360 U	330 U	360 U	104 U	390 U	410 U	390 U	360 U	410 U	400 U	390 U	98.2 U
Aroclor-1248	350 U	320 U	350 U	999	450	190 J	330 U	380 U	340 U	370 U	4800	7000	8000	14000	1100	2400	1340	390 U	2200	1200	6300	800	7700	2000	98.2 U
Aroclor-1254	350 U	320 U	350 U	320	380 U	330 U	330 U	380 U	340 U	370 U	360 U	380 U	380 U	360 U	330 U	360 U	1030	390 U	410 U	390 U	360 U	410 U	400 U	390 U	334
Aroclor-1260	350 U	320 U	350 U	20.2 U	380 U	330 U	330 U	380 U	340 U	370 U	360 U	380 U	380 U	360 U	330 U	360 U	104 U	390 U	410 U	390 U	360 U	410 U	400 U	390 U	98.2 U
Aroclor-1262				20.2 U													104 U								98.2 U
Aroclor-1268				20.2 U													104 U								98.2 U
Total PCBs	350 U	320 U	350 U	1319	640	355	330 U	380 U	340 U	370 U	4980	7190	8190	14180	1265	2580	2370	390 U	2405	1395	6480	1005	7900	2195	383.1

Station ID	TMD-049	TMD-050	TMD-050	TMD-050	TMD-051	TMD-051	TMD-051	TMD-052	TMD-052	TMD-054	TMD-054	TMD-054	TMD-056	TMD-056	TMD-057	TMD-057	TMD-057	TMD-058	TMD-058	TMD-058	TMD-059	TMD-059	TMD-059	TMD-060	TMD-060
Sample ID	TMD-SO-049-1/1.5	TMD-SO-050-0/0.5	TMD-SO-050-1.5/2	TMD-SO-050-1/1.5	TMD-SO-051-0/0.5	TMD-SO-051-1.5/2	TMD-SO-051-1/1.5	TMD-SO-052-0/0.5	TMD-SO-052-1/1.5	TMD-SO-054-0/0.5	TMD-SO-054-1.5/2	TMD-SO-054-1/1.5	TMD-SO-056-0/0.5	TMD-SO-056-1/1.5	TMD-SO-057-0/0.5	TMD-SO-057-1/1.5	TMD-SO-057-2.5/3	TMD-SO-058-0/0.5	TMD-SO-058-1/1.5	TMD-SO-058-2.5/3	TMD-SO-059-0/0.5	TMD-SO-059-1/1.5	TMD-SO-059-2.5/3	TMD-SO-060-0/0.5R1	TMD-SO-060-0/0.5R2
Date Collected	6/6/2013	6/4/2013	6/5/2013	6/4/2013	6/6/2013	6/7/2013	6/6/2013	6/6/2013	6/6/2013	6/6/2013	6/7/2013	6/6/2013	6/6/2013	6/6/2013	9/9/2013	9/9/2013	9/9/2013	9/10/2013	9/10/2013	9/10/2013	9/10/2013	9/10/2013	9/10/2013	9/10/2013	9/10/2013
Depth	1 - 1.5	0 - 0.5	1.5 - 2	1 - 1.5	0 - 0.5	1.5 - 2	1 - 1.5	0 - 0.5	1 - 1.5	0 - 0.5	1.5 - 2	1 - 1.5	0 - 0.5	1 - 1.5	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	0 - 0.5
Analyte (µg/kg)																									
Aroclor-1016	390 U	350 U	360 U	380 U	390 U	108 U	94.9 U	400 U	380 U	370 U	103 U	400 U	410 U	380 U	360 U	360 U	260 U	370 U	340 U	370 U	370 U	360 U	18.1 U	300 U	310 U
Aroclor-1221						108 U	94.9 U				103 U												18.1 U		
Aroclor-1232	390 U	350 U	360 U	380 U	390 U	108 U	94.9 U	400 U	380 U	370 U	103 U	400 U	410 U	380 U	360 U	360 U	260 U	370 U	340 U	370 U	370 U	360 U	18.1 U	300 U	310 U
Aroclor-1242	390 U	350 U	360 U	380 U	390 U	108 U	94.9 U	400 U	380 U	370 U	103 U	400 U	410 U	380 U	360 U	360 U	260 U	370 U	340 U	370 U	370 U	360 U	18.1 U	300 U	310 U
Aroclor-1248	700	3300	840	3000	8700	108 U	2070	7600	380 U	2800	716	3100	950	440	7400	380	260 U	700	340 U	370 U	920	280 J	43.5 J	540	310 U
Aroclor-1254	1100 J	350 U	360 U	380 U	390 U	190	1900 J	400 U	380 U	370 U	220	400 U	410 U	380 U	5900	360 U	260 U	370 U	340 U	370 U	780	360 U	18.1 U	300 U	310 U
Aroclor-1260	390 U	350 U	360 U	380 U	390 U	108 U	94.9 U	400 U	380 U	370 U	103 U	400 U	410 U	380 U	360 U	360 U	260 U	370 U	340 U	370 U	370 U	360 U	18.1 U	300 U	310 U
Aroclor-1262						108 U	94.9 U				103 U												18.1 U		
Aroclor-1268						108 U	94.9 U				103 U												18.1 U		
Total PCBs	1800	3475	1020	3190	8895	244	3970	7800	380 U	2985	936	3300	1155	630	13300	560	260 U	885	340 U	370 U	1700	460	52.55	690	310 U

Station ID	TMD-060	TMD-060	TMD-060	TMD-060	TMD-060	TMD-060	TMD-060	TMD-061	TMD-061	TMD-061	TMD-062	TMD-062	TMD-062	TMD-063	TMD-063	TMD-063	TMD-064	TMD-064	TMD-064	TMD-066	TMD-066	TMD-066	TMD-067	TMD-067	TMD-067
Sample ID	TMD-SO-060-0/0.5R3	TMD-SO-060-1/1.5R1	TMD-SO-060-1/1.5R2	TMD-SO-060-1/1.5R3	TMD-SO-060-2.5/3R1	TMD-SO-060-2.5/3R2	TMD-SO-060-2.5/3R3	TMD-SO-061-0/0.5	TMD-SO-061-1/1.5	TMD-SO-061-2.5/3	TMD-SO-062-0/0.5	TMD-SO-062-1/1.5	TMD-SO-062-2.5/3	TMD-SO-063-0/0.5	TMD-SO-063-1/1.5	TMD-SO-063-2.5/3	TMD-SO-064-0/0.5	TMD-SO-064-1/1.5	TMD-SO-064-2.5/3	TMD-SO-066-0/0.5	TMD-SO-066-1/1.5	TMD-SO-066-2.5/3	TMD-SO-067-0/0.5	TMD-SO-067-1/1.5	TMD-SO-067-2.5/3
Date Collected	9/10/2013	9/10/2013	9/10/2013	9/11/2013	9/10/2013	9/10/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/11/2013	9/12/2013	9/12/2013	9/12/2013	9/12/2013	9/12/2013	9/12/2013
Depth	0 - 0.5	1 - 1.5	1 - 1.5	1 - 1.5	2.5 - 3	2.5 - 3	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3
Analyte (µg/kg)																									
Aroclor-1016	19.1 U	300 U	320 U	360 U	370 U	270 U	330 U	340 U	300 U	370 U	300 U	300 U	300 U	18.9 U	300 U	260 U	310 U	310 U	340 U	320 U	20 U	330 U	330 U	340 U	330 U
Aroclor-1221	19.1 U													18.9 U							20 U				
Aroclor-1232	19.1 U	300 U	320 U	360 U	370 U	270 U	330 U	340 U	300 U	370 U	300 U	300 U	300 U	18.9 U	300 U	260 U	310 U	310 U	340 U	320 U	20 U	330 U	330 U	340 U	330 U
Aroclor-1242	19.1 U	300 U	320 U	360 U	370 U	270 U	330 U	340 U	300 U	370 U	300 U	300 U	300 U	18.9 U	300 U	260 U	310 U	310 U	340 U	320 U	20 U	330 U	330 U	340 U	330 U
Aroclor-1248	619	300 U	320 U	360 U	370 U	270 U	330 U	1400	290 J	370 U	300 U	300 U	300 U	16900	1500	260 U	550	850	340 U	640	979	330 U	1100	410	330 U
Aroclor-1254	341	300 U	320 U	360 U	370 U	270 U	330 U	1300	240 J	370 U	300 U	300 U	300 U	6120	300 U	260 U	310 U	750	340 U	470	540	330 U	630	330 J	330 U
Aroclor-1260	19.1 U	300 U	320 U	360 U	370 U	270 U	330 U	340 U	300 U	370 U	300 U	300 U	300 U	18.9 U	300 U	260 U	310 U	310 U	340 U	320 U	20 U	330 U	330 U	340 U	330 U
Aroclor-1262	19.1 U													18.9 U							20 U				
Aroclor-1268	19.1 U													18.9 U							20 U				
Total PCBs	960	300 U	320 U	360 U	370 U	270 U	330 U	2700	530	370 U	300 U	300 U	300 U	23020	1650	260 U	705	1600	340 U	1110	1519	330 U	1730	740	330 U

Table 2-3. Residential Area Surface Soil (0-3') Analytical Dataset for ERA
Ecological Risk Assessment
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Station ID	TMD-068	TMD-068	TMD-068	TMD-070	TMD-070	TMD-070	TMD-071	TMD-071	TMD-071	TMD-072	TMD-072	TMD-072	TMD-073	TMD-073	TMD-073	TMD-074	TMD-074	TMD-074	TMD-074	TMD-074	TMD-074	TMD-074	TMD-074	TMD-074	TMD-075
Sample ID	TMD-SO-068-0/0.5	TMD-SO-068-1/1.5	TMD-SO-068-2.5/3	TMD-SO-070-0/0.5	TMD-SO-070-1/1.5	TMD-SO-070-2.5/3	TMD-SO-071-0/0.5	TMD-SO-071-1/1.5	TMD-SO-071-2.5/3	TMD-SO-072-0/0.5	TMD-SO-072-1/1.5	TMD-SO-072-2.5/3	TMD-SO-073-0/0.5	TMD-SO-073-1/1.5	TMD-SO-073-2.5/3	TMD-SO-074-0/0.5R1	TMD-SO-074-0/0.5R2	TMD-SO-074-0/0.5R3	TMD-SO-074-1/1.5R1	TMD-SO-074-1/1.5R2	TMD-SO-074-1/1.5R3	TMD-SO-074-2.5/3R1	TMD-SO-074-2.5/3R2	TMD-SO-074-2.5/3R3	TMD-SO-075-0/0.5
Date Collected	9/12/2013	9/12/2013	9/12/2013	9/12/2013	9/13/2013	9/13/2013	9/13/2013	9/13/2013	9/13/2013	9/13/2013	9/13/2013	9/13/2013	9/13/2013	9/13/2013	9/13/2013	9/16/2013	9/16/2013	9/17/2013	9/16/2013	9/16/2013	9/17/2013	9/16/2013	9/16/2013	9/17/2013	9/17/2013
Depth	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	0 - 0.5	0 - 0.5	1 - 1.5	1 - 1.5	1 - 1.5	2.5 - 3	2.5 - 3	2.5 - 3	0 - 0.5
Analyte (µg/kg)																									
Aroclor-1016	310 U	300 U	380 U	370 U	330 U	350 U	310 U	310 U	310 UJ	340 UJ	280 U	290 U	300 U	340 U	270 U	18.8 U	290 U	360 U	320 U	18.8 U	300 U	270 U	320 U	350 U	330 U
Aroclor-1221																18.8 U				18.8 U					
Aroclor-1232	310 U	300 U	380 U	370 U	330 U	350 U	310 U	310 U	310 UJ	340 UJ	280 U	290 U	300 U	340 U	270 U	18.8 U	290 U	360 U	320 U	18.8 U	300 U	270 U	320 U	350 U	330 U
Aroclor-1242	310 U	300 U	380 U	370 U	330 U	350 U	310 U	310 U	310 UJ	340 UJ	280 U	290 U	300 U	340 U	270 U	18.8 U	290 U	360 U	320 U	18.8 U	300 U	270 U	320 U	350 U	330 U
Aroclor-1248	8300	660	230 J	370 U	530	370	3000	310 U	310 UJ	340 UJ	280 U	290 U	300 U	340 U	270 U	1280	540	360 U	280 J	230 J	300 U	270 U	320 U	350 U	330 U
Aroclor-1254	5100	370	380 U	370 U	280 J	350 U	2600	310 U	310 UJ	340 UJ	280 U	290 U	300 U	340 U	270 U	900	540	550	220 J	306	230 J	270 U	320 U	350 U	330 U
Aroclor-1260	310 U	300 U	380 U	370 U	330 U	350 U	310 U	310 U	310 UJ	340 UJ	280 U	290 U	300 U	340 U	270 U	18.8 U	290 U	360 U	320 U	18.8 U	300 U	270 U	320 U	350 U	330 U
Aroclor-1262																18.8 U				18.8 U					
Aroclor-1268																18.8 U				18.8 U					
Total PCBs	13400	1030	420	370 U	810	545	5600	310 U	310 U	340 U	280 U	290 U	300 U	340 U	270 U	2180	1080	730	500	536	380	270 U	320 U	350 U	330 U

Station ID	TMD-075	TMD-077	TMD-077	TMD-077	TMD-078	TMD-078	TMD-078	TMD-078	TMD-078	TMD-078	TMD-078	TMD-078	TMD-078	TMD-079	TMD-079	TMD-080	TMD-080	TMD-081	TMD-081	TMD-082	TMD-082	TMD-083	TMD-083	TMD-084	TMD-084
Sample ID	TMD-SO-075-1/1.5	TMD-SO-077-0/0.5	TMD-SO-077-1/1.5	TMD-SO-077-2.5/3	TMD-SO-078-0/0.5R1	TMD-SO-078-0/0.5R2	TMD-SO-078-0/0.5R3	TMD-SO-078-1/1.5R1	TMD-SO-078-1/1.5R2	TMD-SO-078-1/1.5R3	TMD-SO-078-2.5/3R1	TMD-SO-078-2.5/3R2	TMD-SO-078-2.5/3R3	TMD-SO-079-0/0.5	TMD-SO-079-1/1.5	TMD-SO-080-0/0.5	TMD-SO-080-1/1.5	TMD-SO-081-0/0.5	TMD-SO-081-1/1.5	TMD-SO-082-0/0.5	TMD-SO-082-1/1.5	TMD-SO-083-0/0.5	TMD-SO-083-1/1.5	TMD-SO-084-0/0.5	TMD-SO-084-1/1.5
Date Collected	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/17/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013
Depth	1 - 1.5	0 - 0.5	1 - 1.5	2.5 - 3	0 - 0.5	0 - 0.5	0 - 0.5	1 - 1.5	1 - 1.5	1 - 1.5	2.5 - 3	2.5 - 3	2.5 - 3	0 - 0.5	1 - 1.5	0 - 0.5	1 - 1.5	0 - 0.5	1 - 1.5	0 - 0.5	1 - 1.5	0 - 0.5	1 - 1.5	0 - 0.5	1 - 1.5
Analyte (µg/kg)																									
Aroclor-1016	320 U	360 U	350 U	18.2 U	320 UJ	320 UJ	370 U	340 U	250 U	280 U	340 U	340 U	350 UJ	360 U	19.2 U	290 U	330 U	260 U	290 U	380 U	290 U	390 U	260 U	19 U	330 UJ
Aroclor-1221				18.2 U											19.2 U									19 U	
Aroclor-1232	320 U	360 U	350 U	18.2 U	320 UJ	320 UJ	370 U	340 U	250 U	280 U	340 U	340 U	350 UJ	360 U	19.2 U	290 U	330 U	260 U	290 U	380 U	290 U	390 U	260 U	19 U	330 UJ
Aroclor-1242	320 U	360 U	350 U	18.2 U	320 UJ	320 UJ	370 U	340 U	250 U	280 U	340 U	340 U	350 UJ	360 U	19.2 U	290 U	330 U	260 U	290 U	380 U	290 U	390 U	260 U	19 U	330 UJ
Aroclor-1248	320 U	4800	180 J	238	1900 J	1200 J	2400	980	810	500	340 U	340 U	350 UJ	360 U	19.2 U	290 U	330 U	200 J	290 U	380 U	290 U	390 U	260 U	19 U	330 UJ
Aroclor-1254	750	4600	350 U	91.5 J	1100 J	760 J	1500	550	520	320	340 U	340 U	350 UJ	360 U	19.2 U	290 U	330 U	270 J	290 U	380 U	290 U	390 U	260 U	19 U	330 UJ
Aroclor-1260	320 U	360 U	350 U	18.2 U	320 UJ	320 UJ	370 U	340 U	250 U	280 U	340 U	340 U	350 UJ	360 U	19.2 U	290 U	330 U	260 U	290 U	380 U	290 U	390 U	260 U	19 U	330 UJ
Aroclor-1262				18.2 U											19.2 U									19 U	
Aroclor-1268				18.2 U											19.2 U									19 U	
Total PCBs	910	9400	355	329.5	3000	1960	3900	1530	1330	820	340 U	340 U	350 U	360 U	19.2 U	290 U	330 U	470	290 U	380 U	290 U	390 U	260 U	19 U	330 U

Station ID	TMD-085	TMD-086	TMD-087
Sample ID	TMD-SO-085-0/0.5	TMD-SO-086-0/0.5	TMD-SO-087-0/0.5
Date Collected	9/19/2013	9/19/2013	9/19/2013
Depth	0 - 0.5	0 - 0.5	0 - 0.5
Analyte (µg/kg)			
Aroclor-1016	280 U	250 U	260 U
Aroclor-1221			
Aroclor-1232	280 U	250 U	260 U
Aroclor-1242	280 U	250 U	260 U
Aroclor-1248	3400	1500	840
Aroclor-1254	2200	250 U	750
Aroclor-1260	280 U	250 U	260 U
Aroclor-1262			
Aroclor-1268			
Total PCBs	5600	1625	1590

U - Not detected
J - Estimated detection
µg/kg - micrograms per kilogram

Table 2-4. Martian Drain Surface Soil (0-3') Analytical Dataset for ERA

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Sample ID	Sample Interval (feet)	Result Total PCBs	
TMD-SO-088-2/3	2/3	0.094	U
TMD-SO-089-2/3	2/3	0.092	U
TMD-SO-090-2/3	2/3	0.10	U
TMD-SO-091-2/3	2/3	0.17	
TMD-SO-092-2/3	2/3	0.11	U
TMD-SO-093-2/3	2/3	0.080	U
TMD-SO-094-2/3	2/3	0.099	
TMD-SO-097-1.5/2.5	1.5/2.5	0.10	U
TMD-SO-098-0.3/1.3	0.3/1.3	0.083	U
TMD-SO-099-1.8/2.8	1.8/2.8	0.95	
TMD-SO-100-1.4/2.4	1.4/2.4	0.093	U
TMD-SO-101-1/2	1/2	0.092	U
TMD-SO-101-2/3	2/3	0.10	U
TMD-SO-101-2/3-R	2/3	0.10	U
TMD-SO-103-1.4/2.4	1.4/2.4	0.095	U
TMD-SO-107-1.9/2.9	1.9/2.9	2.6	
TMD-SO-111-1.5/2.5	1.5/2.5	0.074	U
TMD-SO-112-1.7/2.7	1.7/2.7	0.081	U
TMD-SO-113-2/3	2/3	0.084	U
TMD-SO-119-1.3/2.3	1.3/2.3	0.11	U
TMD-SO-120-1.4/2.4	1.4/2.4	2.4	
TMD-SO-120-1.4/2.4-R	1.4/2.4	1.9	
TMD-SO-122-1.6/2	1.6/2	0.10	U
TMD-SO-122-2/2.4	2/2.4	0.12	U
TMD-SO-122-2/2.4-R	2/2.4	0.11	U
TMD-SO-123-1.1/2.1	1.1/2.1	0.11	U

Table 2-5. ERA Sediment Analytical Data Set

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

StationID	c001	c002	c003	c004	c005	c006	c007	c008	c009	c010	c011	c012	c013	c014	c015	c016	c017	c018	c019	c020	c021	c022	c023	c024	c025	c026	c027	c028	c029	c030
SampleID	LR_SD_c001_0_6	LR_SD_c002_0_6	LR_SD_c003_0_6	LR_SD_c004_0_6	LR_SD_c005_0_6	LR_SD_c006_0_6	LR_SD_c007_0_6	LR_SD_c008_0_6	LR_SD_c009_0_6	LR_SD_c010_0_6	LR_SD_c011_0_6	LR_SD_c012_0_6	LR_SD_c013_0_6	LR_SD_c014_0_6	LR_SD_c015_0_6	LR_SD_c016_0_6	LR_SD_c017_0_6	LR_SD_c018_0_6	LR_SD_c019_0_6	LR_SD_c020_0_6	LR_SD_c021_0_6	LR_SD_c022_0_6	LR_SD_c023_0_6	LR_SD_c024_0_6	LR_SD_c025_0_6	LR_SD_c026_0_6	LR_SD_c027_0_6	LR_SD_c028_0_6	LR_SD_c029_0_6	LR_SD_c030_0_6
DateCollected	8/25/2011	8/25/2011	8/25/2011	8/27/2011	8/27/2011	8/27/2011	8/27/2011	8/29/2011	8/29/2011	8/29/2011	8/29/2011	8/29/2011	8/29/2011	8/29/2011	8/30/2011	8/30/2011	8/30/2011	8/30/2011	8/30/2011	8/30/2011	8/30/2011	8/30/2011	8/30/2011	8/31/2011	8/31/2011	8/31/2011	8/31/2011	8/31/2011	8/31/2011	########
Depth (ft)	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Analyte (µg/kg)																														
Aroclor-1016	19000	5700	23000	180000	78000 J	38000 J	5900	4600	14000	12000	5300	23000	12000	12000	37000 J	18000	900 U	6400	2900	3100	4600	2600	19000	5800	7600	7000	5000	28000	170000	130000
Aroclor-1232	700 U	400 U	610 U	1600 U	1500 U	700 U	2400 U	460 U	620 U	570 U	450 U	700 U	410 U	420 U	720 U	700 U	900 U	1100 U	1400 U	1100 U	880 U	940 U	1100 U	710 U	740 U	570 U	580 U	750 U	6300 U	570 U
Aroclor-1242	700 U	400 U	610 U	1600 U	1500 U	700 U	2400 U	460 U	620 U	570 U	450 U	700 U	410 U	420 U	720 U	700 U	900 U	1100 U	1400 U	1100 U	880 U	940 U	1100 U	710 U	740 U	570 U	580 U	750 U	6300 U	570 U
Aroclor-1248	700 U	400 U	610 U	1600 U	1500 U	700 U	2400 U	460 U	620 U	570 U	450 U	700 U	410 U	420 U	720 U	700 U	3800	1100 U	1400 U	1100 U	880 U	940 U	1100 U	710 U	740 U	570 U	580 U	750 U	6300 U	570 U
Aroclor-1254	700 U	400 U	610 U	1600 U	1500 U	700 U	2400 U	460 U	620 U	570 U	450 U	700 U	410 U	420 U	720 U	700 U	900 U	1100 U	1400 U	1100 U	880 U	940 U	1100 U	710 U	740 U	570 U	580 U	750 U	6300 U	570 U
Aroclor-1260	700 U	400 U	1000	1600 U	1500 U	1700	2400 U	460 U	620 U	570 U	450 U	980	530	450	2000	790	900 U	1100 U	1400 U	1100 U	880 U	940 U	1100 U	710 U	740 U	570 U	580 U	700 J	6300 U	1300
Total PCBs	19350	5900	24000	180800	78750	39700	7100	4830	14310	12285	5525	23980	12530	12450	39000	18790	4700	6950	3600	3650	5040	3070	19550	6155	7970	7285	5290	28700	173150	131300

StationID	c031	c032	c033	c034	c035	c036	c037	c038	c039	c040	c041	p001	p002	p003	p004	p005	p006	p007	p008	p009	p010	p011	p012	p013	p014	p015	p016	p017	p018
SampleID	LR_SD_c031_0_6	LR_SD_c032_0_6	LR_SD_c033_0_6	LR_SD_c034_0_6	LR_SD_c035_0_6	LR_SD_c036_0_6	LR_SD_c037_0_6	LR_SD_c038_0_6	LR_SD_c039_0_6	LR_SD_c040_0_6	LR_SD_c041_0_6	LR_SD_p001	LR_SD_p002	LR_SD_p003	LR_SD_p004	LR_SD_p005	LR_SD_p006	LR_SD_p007	LR_SD_p008	LR_SD_p009	LR_SD_p010	LR_SD_p011	LR_SD_p012	LR_SD_p013	LR_SD_p014	LR_SD_p015	LR_SD_p016	LR_SD_p017	LR_SD_p018
DateCollected	8/31/2011	8/31/2011	8/31/2011	9/1/2011	9/1/2011	9/1/2011	9/1/2011	9/1/2011	9/1/2011	9/1/2011	9/1/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011
Depth (ft)	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Analyte (µg/kg)																													
Aroclor-1016	140000	210000	5900	280000	440000	170000	65000	44000 J	26000	320 U	220 U	450 J	660	390 U	3800	8100	5100	7100	9300	10000	2900	28000	9900	1200 J	3900 J	2600 J	450 J	2000 J	1000 J
Aroclor-1232	2900 U	4300 U	730 U	7800 U	9300 U	7700 U	860 U	720 U	740 U	320 U	220 U	480 U	580 U	390 U	1800 U	630 U	2100 U	3200 U	1600 U	1800 U	510 U	840 U	840 U	600 UJ	1200 UJ	1100 UJ	480 UJ	780 UJ	570 UJ
Aroclor-1242	2900 U	4300 U	730 U	7800 U	9300 U	7700 U	860 U	720 U	740 U	320 U	220 U	480 U	580 U	390 U	1800 U	630 U	2100 U	3200 U	1600 U	1800 U	510 U	840 U	840 U	600 UJ	1200 UJ	1100 UJ	480 UJ	780 UJ	570 UJ
Aroclor-1248	2900 U	4300 U	730 U	7800 U	9300 U	7700 U	860 U	720 U	740 U	320 U	220 U	480 U	580 U	390 U	1800 U	630 U	2100 U	3200 U	1600 U	1800 U	510 U	840 U	840 U	600 UJ	1200 UJ	1100 UJ	480 UJ	780 UJ	570 UJ
Aroclor-1254	2900 U	4300 U	730 U	800 U	9300 U	7700 U	860 U	720 U	740 U	320 U	220 U	480 U	580 U	390 U	1800 U	630 U	2100 U	3200 U	1600 U	1800 U	510 U	840 U	840 U	600 UJ	1200 UJ	1100 UJ	480 UJ	780 UJ	570 UJ
Aroclor-1260	2900 U	4300 U	730 U	7800 U	9300 U	7700 U	26000	720 U	740 U	320 U	220 U	480 U	580 U	390 U	1800 U	630 U	2100 U	3200 U	1600 U	1800 U	510 U	840 U	840 U	600 UJ	1200 UJ	1100 UJ	480 UJ	780 UJ	570 UJ
Total PCBs	141450	212150	6265	283900	444650	173850	91000	44360	26370	320 U	220 U	690	950	390 U	4700	8415	6150	8700	10100	10900	3155	28420	10320	1500	4500	3150	690	2390	1285

StationID	p019	p020	p021	p022	p023	p024	p025	p026	p027	p028	p029	p030	p031	p032	p033	p034	p035	p036	p037	p038	p039	p040	p041	p042	p043	p044	p045	p046	p047
SampleID	LR_SD_p019	LR_SD_p020	LR_SD_p021	LR_SD_p022	LR_SD_p023	LR_SD_p024	LR_SD_p025	LR_SD_p026	LR_SD_p027	LR_SD_p028	LR_SD_p029	LR_SD_p030	LR_SD_p031	LR_SD_p032	LR_SD_p033	LR_SD_p034	LR_SD_p035	LR_SD_p036	LR_SD_p037	LR_SD_p038	LR_SD_p039	LR_SD_p040	LR_SD_p041	LR_SD_p042	LR_SD_p043	LR_SD_p044	LR_SD_p045	LR_SD_p046	LR_SD_p047
DateCollected	8/26/2011	8/26/2011	8/26/2011	8/25/2011	8/25/2011	8/25/2011	8/25/2011	8/25/2011	8/25/2011	8/25/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/26/2011	8/25/2011	8/25/2011
Depth (ft)	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Analyte (µg/kg)																													
Aroclor-1016	5000 J	2000 J	2300 J	2900	2700	3400 J	17000	12000	110000	150000	370 U	1800	1400	4000	9300	11000	6600	15000	7800	2500	6300	2400	1100 J	1400 J	3400 J	6000 J	2500 J	6500	22000
Aroclor-1232	930 UJ	590 UJ	730 UJ	510 U	440 U	670 UJ	650 U	390 U	480 U	2400 U	370 U	720 U	490 U	1900 U	3500 U	2600 U	1800 U	710 U	630 U	500 U	680 U	340 U	620 UJ	640 UJ	800 UJ	920 UJ	640 UJ	620 U	670 U
Aroclor-1242	930 UJ	590 UJ	730 UJ	510 U	440 U	670 UJ	650 U	390 U	480 U	2400 U	370 U	720 U	490 U	1900 U	3500 U	2600 U	1800 U	710 U	630 U	500 U	680 U	340 U	620 UJ	640 UJ	800 UJ	920 UJ	640 UJ	620 U	670 U
Aroclor-1248	930 UJ	590 UJ	730 UJ	510 U	440 U	670 UJ	650 U	390 U	480 U	2400 U	370 U	720 U	490 U	1900 U	3500 U	2600 U	1800 U	710 U	630 U	500 U	680 U	340 U	620 UJ	640 UJ	800 UJ	920 UJ	640 UJ	620 U	670 U
Aroclor-1254	930 UJ	590 UJ	730 UJ	510 U	440 U	670 UJ	650 U	390 U	480 U	2400 U	370 U	720 U	490 U	1900 U	3500 U	2600 U	1800 U	710 U	630 U	500 U	680 U	340 U	620 UJ	640 UJ	800 UJ	920 UJ	640 UJ	620 U	670 U
Aroclor-1260	930 UJ	590 UJ	730 UJ	510 U	440 U	670 UJ	320 J	390 U	410 J	2400 U	370 U	720 U	490 U	1900 U	3500 U	2600 U	1800 U	710 U	630 U	500 U	680 U	340 U	620 UJ	640 UJ	800 UJ	920 UJ	640 UJ	620 U	670 U
Total PCBs	5465	2295	2665	3155	2920	3735	17320	12195	110410	151200	370 U	2160	1645	4950	11050	12300	7500	15355	8115	2750	6640	2570	1410	1720	3800	6460	2820	6810	22335

StationID	p048	p049	p050	p051	p052	p053	p054	p055	p056	p057	p058	p059	p060	p061	p062	p063	p064	p065	p066	p067	p068	p069	p070	p071	p072	p073	p074	p075	p076
SampleID	LR_SD_p048	LR_SD_p049	LR_SD_p050	LR_SD_p051	LR_SD_p052	LR_SD_p053	LR_SD_p054	LR_SD_p055	LR_SD_p056	LR_SD_p057	LR_SD_p058	LR_SD_p059	LR_SD_p060	LR_SD_p061	LR_SD_p062	LR_SD_p063	LR_SD_p064	LR_SD_p065	LR_SD_p066	LR_SD_p067	LR_SD_p068	LR_SD_p069	LR_SD_p070	LR_SD_p071	LR_SD_p072	LR_SD_p073	LR_SD_p074	LR_SD_p075	LR_SD_p076
DateCollected	8/25/2011	8/25/2011	8/26/2011	8/25/2011	8/25/2011	8/23/2011	8/25/2011	8/25/2011	8/24/2011	8/25/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/23/2011	8/23/2011	8/23/2011	8/23/2011	8/24/2011	8/23/2011	8/23/2011	8/25/2011
Depth (ft)	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Analyte (µg/kg)																													
Aroclor-1016	28000	120000	30000 J	290 U	570000	360 U	3800	3200	1700	3600	4600	5100	4100	8900	11000	25000	11000	11000	7400	1700	880	5100	14000	3000	17000	270000	81000	900 U	1100 J
Aroclor-1232	1100 U	2300 U	990 UJ	290 U	12000 U	360 U	420 U	380 U	600 U	290 U	790 U	470 U	300 U	670 U	530 U	610 U	570 U	480 U	540 U	320 U	330 U	240 U	380 U	320 U	3200 U	2300 U	2800 U	900 U	270 U
Aroclor-1242	1100 U	2300 U	990 UJ	290 U	12000 U	360 U	420 U	380 U	600 U	290 U	790 U	470 U	300 U	670 U	530 U	610 U	570 U	480 U	540 U	320 U	330 U	240 U	380 U	320 U	3200 U	2300 U	2800 U	900 U	270 U
Aroclor-1248	1100 U	2300 U	990 UJ	290 U	12000 U	360 U	420 U	380 U	600 U	290 U	790 U	470 U	300 U	670 U	530 U	610 U	570 U	480 U	540 U	320 U	330 U	240 U	380 U	320 U	3200 U	2300 U	2800 U	900 U	270 U
Aroclor-1254	1100 U	2300 U	990 UJ	290 U	12000 U	360 U	420 U	380 U	600 U	290 U	790 U	470 U	300 U	670 U	530 U	610 U	570 U	480 U	540 U	320 U	330 U	240 U	380 U	320 U	3200 U	2300 U	2800 U	900 U	270 U
Aroclor-1260	1100 U	2300 U	990 UJ	290 U	12000 U	360 U	420 U	380 U	600 U	290 U	790 U	290 J	300 U	340 J	380 J	870	570 U	480 U	540 U	320 U	330 U	240 U	380 U	320 U	3200 U	3500	2800 U	900 U	270 U
Total PCBs	28550	121150	30495	290 U	576000	360 U	4010	3390	2000	3745	4995	5390	4250	9240	11380	25870	11285	11240	7670	1860	1045	5220	14190	3160	18600	273500	82400	900 U	1235

StationID	p077	p078	p079	p080	p081	p082	p083	p084	p085	p086	p087	p088	p089	p090	p091	p092	p093	p094	p095	p096	p097	p098	p099	p100	p200	p201	p202	p300	p301
SampleID	LR_SD_p077	LR_SD_p078	LR_SD_p079	LR_SD_p080	LR_SD_p081	LR_SD_p082	LR_SD_p083	LR_SD_p084	LR_SD_p085	LR_SD_p086	LR_SD_p087	LR_SD_p088	LR_SD_p089	LR_SD_p090	LR_SD_p091	LR_SD_p092	LR_SD_p093	LR_SD_p094	LR_SD_p095	LR_SD_p096	LR_SD_p097	LR_SD_p098	LR_SD_p099	LR_SD_p100	LR_SD_p200	LR_SD_p201	LR_SD_p202	LR_SD_p300	LR_SD_p301
DateCollected	8/25/2011	8/25/2011	8/25/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/23/2011	8/23/2011	8/23/2011	8/23/2011	8/23/2011	8/24/2011	8/23/2011	8/31/2011	8/31/2011	8/31/2011	9/1/2011	9/1/2011
Depth (ft)	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Analyte (µg/kg)																													
Aroclor-1016	830 J	1200 J	49000	13000	1500 J	7600	4100	3900	4300	9000	1700	2800	26000	4800	20000	930	91000	16000 J	29000 J	130000	85000	53000	77000	1400 U	1100 U	880 U	990 U	270000	320000
Aroclor-1232	360 U	220 U	2900 U	870 U	780 U	560 U	480 U	570 U	390 U	210 U	340 U	310 U	560 U	320 U	530 U	340 U	590 U	300 U	690 U	4100 U	2100 U	1700 U	3400 U	1400 U	1100 U	880 U	990 U	94000 U	9800 U
Aroclor-1242	360 U	220 U	2900 U	870 U	780 U	560 U	480 U	570 U	390 U	210 U	340 U	310 U	560 U	320 U	530 U	340 U	590 U	300 U	690 UJ	4100 U	2100 U	1700 U	3400 U	1400 U	1100 U	880 U	990 U	94000 U	9800 U
Aroclor-1248	360 U	220 U	2900 U	870 U	780 U	560 U	480 U	570 U	390 U	210 U	340 U	310 U	560 U	320 U	530 U	340 U	590 U	300 U	690 UJ	4100 U	2100 U	1700 U	3400 U	1400 U	1100 U	880 U	990 U	94000 U	9800 U
Aroclor-1254	360 U	220 U	2900 U	870 U	780 U	560 U	480 U	570 U	390 U	210 U	340 U	310 U	560 U	320 U	530 U	340 U	590 U	300 U	690 UJ	4100 U	2100 U	1700 U	3400 U	1400 U	1100 U	880 U	990 U	94000 U	9800 U
Aroclor-1260	360 U	220 U	2900 U	600 J	780 U	560 U	480 U	570 U	390 U	210 U	340 U	310 U	920	320 U	400 J	340 U	1500	300 U	690 UJ	1000	310 J	1700 U	3400 U	1400 U	1100 U	880 U	990 U	94000 U	9800 U
Total PCBs	1010	1310	50450	13600	1890	7880	4340	4185	4495	9105	1870	2955	26920	4960	20400	1100	92500	16150	29345	131000	85310	53850	78700	1400 U	1100 U	880 U	990 U	317000	324900

U - Not detected

J - Estimated detection

µg/kg - micrograms per kilogram

Table 2-6. ERA Surface Water Analytical Data Set

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

StationID	**Outfall**	**Outfall**	**Outfall**	**Outfall**	**Outfall**
SampleID	**Outfall_022411**	**Outfall_051910**	**Outfall_062211**	**Outfall_081811**	**Outfall_111710**
DateCollected	**2/24/2011**	**5/19/2010**	**6/22/2011**	**8/18/2011**	**11/17/2010**
Analyte (µg/L)					
Total PCBs	0.69	8.2	1.8	0.92	1.1

U - Not detected

J - Estimated detection

µg/L - micrograms per liter

Table 2-7. ERA Fish Analytical Data Set

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

SampleID	2010303-S01	2010303-S02	2010303-S03	2010303-S04	2010303-S05	2010303-S06	2010303-S07	2010303-S08	2010303-S09	2010303-S10	2010303-S11	2010303-S12	2010303-S13
DateCollected	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010
Fish Collected	Pumpkinseed	Pumpkinseed	Pumpkinseed	Pumpkinseed	Pumpkinseed	Black Crappie	Black Crappie	Black Crappie	Black Crappie	Black Crappie	Black Crappie	Black Crappie	Black Crappie
Analyte (µg/kg)													
Total PCBs -Congeners	14806.5	12908	11736.9	2661.8	758.8	22876.4	13973.8	11800.4	22021.8	20077.2	14456.2	311.5	14366.3

SampleID	2010303-S14	2010303-S15	2010303-S16	2010303-S17	2010303-S18	2010303-S19	2010303-S20	2010303-S21	2010303-S22	2010303-S23	2010303-S24	2010303-S25	2010303-S26
DateCollected	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010
Fish Collected	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass
Analyte (µg/kg)													
Total PCBs -Congeners	647.1	4690.8	841.6	8185	2753.6	2198.8	5365.2	5072.7	1425.8	3143.1	2105.3	8287.3	3823.4

SampleID	2010303-S27	2010303-S28	2010303-S29	2010303-S30	2010303-S31	2010303-S32	2010303-S33	2010303-S34	2010303-S35	2010303-S36	2010303-S37	2010303-S38
DateCollected	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010	4/28/2010
Fish Collected	Carp	Carp	Carp	Carp	Carp	Carp	Carp	Carp	Carp	Carp	Carp	Carp
Analyte (µg/kg)												
Total PCBs -Congeners	59374.4	40296.3	93125	12751.2	21298.5	129878.7	132470.6	111966.3	82155.1	201425.3	29092.7	85914.3

Notes:
U - Not detected
J - Estimated detection
µg/kg - micrograms per kilogram

Table 3-1. Exposure Parameters for Upper-Trophic-Level Ecological Receptors

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

	Mean Body Weight (BW) (kg)		Food Ingestion Rate (kg/kg-BW/day - dry)[b]		Water Ingestion Rate (L/day)[a]		Dietary Composition (proportion)						Soil/ Sediment Ingestion		Home Range (ha)	
Receptor	**Value**	**Reference**	**Value**	**Reference**	**Value**	**Reference**	**Terr. Plants**	**Soil Invert.**	**Fish**	**Aquatic Plants**	**Benthic Invert.**	**Reference**	**Value**	**Reference**	**Value**	**Reference**
Mammals																
Short-tailed shrew	0.017	USEPA 1993	0.1282	Nagy, 2001	0.005	USEPA 1993	0.047	0.823	0	0	0	USEPA 1993; Sample and Suter 1994	0.130	Sample and Suter 1994	0.39	Sample and Suter 1994
Mink	0.87	M/F - IN; Silva and Downing 1995	0.0497	Nagy, 2001	0.024	2.8% of max BW; USEPA 1993	0	0	1.0	0	0	USEPA 1993	0.000	Sample and Suter 1994	20.4	Mitchell 1961; EPA 1993
Birds																
American robin	0.077	USEPA 1993	0.1498	Nagy, 2001	0.014	allometric equation	0.519	0.435	0	0	0	Martin et al. 1951	0.046	Sample and Suter 1994	0.15	Weatherhead & McRae 1990; EPA 1993
Belted kingfisher	0.17	Dunning 1993	0.0215	Nagy, 2001	0.011	allometric equation	0	0	0.84	0	0.16	USEPA 1993	0.0	Sample and Suter 1994	103.0	Brooks & Davis 1987; EPA 1993

Nagy (2001) regression equation format --> dry matter g/day/g = *a* (grams body weight)^{b}

Group	***a***	***b***	
Birds			
all birds	0.638	0.685	kingfisher
insectivorous birds	0.54	0.705	robin
Mammals			
insectivorous mammals	0.373	0.622	shrew
carnivorous mammals	0.153	0.834	mink

[a] Calculated water ingestion rate from body weight using Nagy's allometric equations for all birds as reported in EPA, 1993; water ingestion rate all birds = (0.059*(minimum body weight^0.67))/minimum body weight and using allometric equations for all mammals as reported in EPA, 1993; water ingestion rate all mammals = (0.099*(body weight^0.9))/body weight.

[b] Food ingestion rates are calculated using Nagy 2001 and the mean body weight listed unless otherwise noted.

Acronyms:

BW - body weight

FIR - Food ingestion rate

Table 3-2. Lower-Trophic-Level Ecological Screening Values and Exposure Point Concentrations

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Analyte	Ecological Screening Value	Reference	EPC	Basis[a]
Surface soil (µg/kg)				
Total PCB	0.332	EPA 2003	1159.0	95% KM (BCA) UCL
Surface water (µg/L)				
Total PCB	0.00012	EPA 2003	9.1	95% Approximate Gamma UCL
Sediment (µg/kg)				
Total PCB	59.8	EPA 2003	80071.9	97.5% KM (Chebyshev) UCL
Fish (µg/k WW)				
Total PCB	440.0	Dyer 2000	65014.2	95% Chebyshev (Mean, Sd) UCL

[a] EPCs calculated from the EPA ProUCL 4.1 software at: http://www.epa.gov/osp/hstl/tsc/software.htm

EPC - Exposure point concentration

µg/kg - micrograms per kilogram

µg/L - micrograms per liter

WW = Wet weight

Table 3-3. Plant BCFs and Invertebrate BAFs

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Contaminant	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)		Soil-Small mammal BAF (dry weight)		Log K_{ow}	
	Value	Reference	Value	Reference	Value	Reference	Value	Reference
Total PCB	10^((-0.4057*5.58) +1.781)	EPA 2007a	EXP(1.41+(1.361*(LN(Soil Concentration))))	Sample et al. 1998a	10^(-0.099*((5.58)^2) +1.07*(5.58)-3.56)	RTI, 2005	5.58	MDEQ 2013

Contaminant	Sediment-Plant BCF		Sediment-Invertebrate BAF		Fish BSAF		
	Value	Reference	Value	Reference			
Total PCB	10^((-0.4057*5.58) +1.781)	EPA 2007a	21.89	90th percentile value from Bechtel Jacobs, 1998	5	EPA 2009	

LN - natural log

K_{ow} - octanol water coefficient

BCF - bioconcentraton factor

BAF - bioaccumulation factor

BSAF = biota sediment accumulation factor (Attachment A)

Table 4-1. Ingestion Screening Values for Birds and Mammals

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Contaminant	Test Organism	Duration	Effect/Endpoint	LOAEL (mg/kg-bw/d)	MATC (mg/kg-bw/d)	NOAEL (mg/kg-bw/d)	Reference	Uncertianty Factors: LOAEL to NOAEL	Uncertianty Factors: Suchronic to Chronic	Uncertianty Factors: Acute to Chronic	Uncertianty Factors: LD50 to Chronic NOAEL
Total PCB	chicken	multi-generation	reproduction/ hatchability	0.5	0.45	0.4	CDM 2003				
Total PCB	mouse	multi-generation	reproduction and a reduction in body weight	0.68	0.40	0.23	McCoy et al. 1995				
Total PCB	mink	multi-generation	reproduction and a reduction in body weight	0.11	0.10	0.09	CDM 2003	3			

LOAEL - lowest observed adverse effect levels

NOAEL - no observable adverse effects levels

LD50 - Lethal Dose to 50% of test organisms

LD - Live days (post partum)

GD - Gestational days

Table 5-1. Lower-Trophic-Level Screening Evaluation
Ecological Risk Assessment
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Maximum Hazard Quotient[1]	Detected and Exceeds	Nondetected and Exceeds	Detected and No Screening Value	Not a COPEC
Surface Soil (µg/kg)										
Total PCBs	19 - 440	149 - 320	23000	TMD-SO-063-0/0.5	0.332	69277.1	X	X		
Surface water (µg/L)										
Total PCB	-	5 - 5	8.2	Outfall_051910	0.00012	68333.3	X			
Sediment (µg/kg)										
Total PCB	220 - 1400	135 - 146	576000	LR_SD_p052	59.8	9632.1	X	X		
Fish (µg/k WW)										
Total PCB	-	38 - 38	201000	2010303-S36	440	456.8	X			

Shaded cell indicates an HQ >1
COPC - constituent of potential ecological concern
NSV - no screening value available
PCB - polychlorinated biphenyls
µg/kg - micrograms per kilogram
µg/L - micrograms per liter

Table 6-1. Refined-Lower-Trophic Level Evaluation
Ecological Risk Assessment
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

AnalyteName	Frequency of Detection	EPC	Lower Threshold Screening Value	Lower Threshold Reference	EPC/ Lower Threshold Hazard Quotient	Frequency of Exceedance	Maximum Concentration Detected	Upper Threshold Effect Value	Upper Threshold Reference	MAX/ Upper Threshold Hazard Quotient	EPC < Screening Value	MAX < Upper threshold	Not a COPEC
Surface Soil (µg/kg)													
Total PCB	140 - 278	1159	0.332	EPA 2003	3491	138 - 278	23000	40000	Efroymson et al. 1997; plants	<1			
Surface water (µg/L)													
Total PCB	5 - 5	9	0.00012	EPA 2003	75566	5 - 5	8.2	0.014	USEPA 2009	586			
Sediment (µg/kg)													
Total PCB	135 - 146	80072	59.8	EPA 2003	1339	135 - 146	576000	676	MacDonald, 2000; PEC	852			
Fish (µg/kg)													
Total PCB	38 - 38	65014	440	Dyer 2000	148	37 - 38	201000	NA		NA			

Shaded hazard quotients greater than 1
COPEC - Constituent of potential ecological concern
EPC - Exposure point concentration
ESV - Ecological screening value
µg/Kg - micrograms per kilogram
µg/L - micrograms per liter

Table 6-2. Upper-Trophic-Level Wildlife Hazard Quotients

Ecological Risk Assessment

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Chemical	Soil/ Sediment EPC (mg/kg)	Body Weight (kg)	Daily Food Intake (kg/kg-bw/day)	Site Use Factor	Daily Food Ingestion from Site (kg/kg-bw/day)	Proportional Diet as Plant	Soil to Plant Transfer Factor	Plant Tissue Uptake (mg/kg BW/d)(DW)	Proportional Diet as Invertebrates	Soil to Invertebrate Transfer Factor	Invertebrate Tissue Uptake (mg/kg-BW/d)(DW)	Proportional Diet as Vertebrate	Soil to Vertebrate (fish)Transfer Factor	Vertebrate (fish) Tissue Uptake (mg/kg BW/d)(DW)	Fraction of Soil in Diet	Incidental Soil/ Sediment Intake (mg/kg-bw/d)	DWIR (L/kg-BW/d)	Water concentration (mg/L)	Incidental Water Intake (mg/kg-bw/d)	Total Chemical Intake (mg/kg-bw/d)	NOAEL TRV (mg/kg-bw/d)	NOAEL Hazard Quotient	MATC (mg/kg-bw/d)	MATC Hazard Quotient	LOAEL TRV (mg/kg-bw/d)	LOAEL Hazard Quotient	Retain
Short-tailed shrew																											
Total PCB	1.16	0.02	0.13	1.00	0.13	0.05	10^((-0.4057*5.58)+1.781)	0.002	0.82	EXP(1.41+(1.361*(LN(Soil Concentration))))	0.53	0.00	10^(-0.099*((5.58)^2)+1.07*(5.58)-3.56)	0.00	0.13	0.02	0.00	0.01	0.00	0.55	0.23	**2.39**	0.40	**1.39**	0.68	0.81	**Yes**
American robin																											
Total PCB	1.16	0.08	0.15	1.00	0.15	0.52	10^((-0.4057*5.58)+1.781)	0.03	0.44	EXP(1.41+(1.361*(LN(Soil Concentration))))	0.33	0.00	10^(-0.099*((5.58)^2)+1.07*(5.58)-3.56)	0.00	0.05	0.01	0.01	0.01	0.00	0.36	0.40	0.90	0.45	0.80	0.50	0.72	No
Mink																											
Total PCB	80.07	0.87	0.05	1.00	0.05	0.00	10^((-0.4057*5.58)+1.781)	0.00	0.00	21.89	0.00	1.00	5.00	0.25	0.00	0.00	0.02	0.01	0.00	0.25	0.09	**2.73**	0.10	**2.49**	0.11	**2.26**	**Yes**
Belted Kingfisher																											
Total PCB	80.07	0.17	0.02	1.00	0.02	0.00	10^((-0.4057*5.58)+1.781)	0.00	0.16	21.89	6.03	0.84	5.00	0.09	0.00	0.00	0.01	0.01	0.00	6.12	0.40	**15.31**	0.45	**13.69**	0.50	**12.24**	**Yes**

EPC = Exposure point concentration
For the screening, it has been conservatively assumed that all chemical intake is absorbed by the receptor
Bold = Site specific dose greater than TRV
kg = Kilograms.
mg/kg-bw/day = Milligrams per kilogram of body weight per day.
NOAEL = No observed adverse effect level
TRV = Toxicological reference value
Food intake from vertebrates = (daily food ingestion from site) X (fraction of diet as vertebrate) X (media to vertebrate transfer factor) X (medium concentration)
Food intake from invertebrates = (daily food ingestion from site) X (fraction of diet as invertebrates) X (soil to invertebrate transfer factor) X (medium concentration)
Food intake from plants = (daily food ingestion from site) X (fraction of diet as plants) X (soil to plant transfer factor) X (medium concentration)
Incidental soil intake = (daily food ingestion from site) X (fraction of diet as soil) X soil concentration).
Total chemical intake = (Drinking water ingestion) + (food intake from vertebrates) + (food intake from invertebrates) + (food intake from plants) + (incidental soil intake

Figures

N

0 300 600

Approximate scale in feet

Note:
©2013 Google Aerial Dated May 9, 2010

FIGURE 1-1
Site Location and Investigation Areas Map
Ten-Mile Drain Ecological Risk Assessment
Saint Clair Shores, Michigan

CH2MHILL

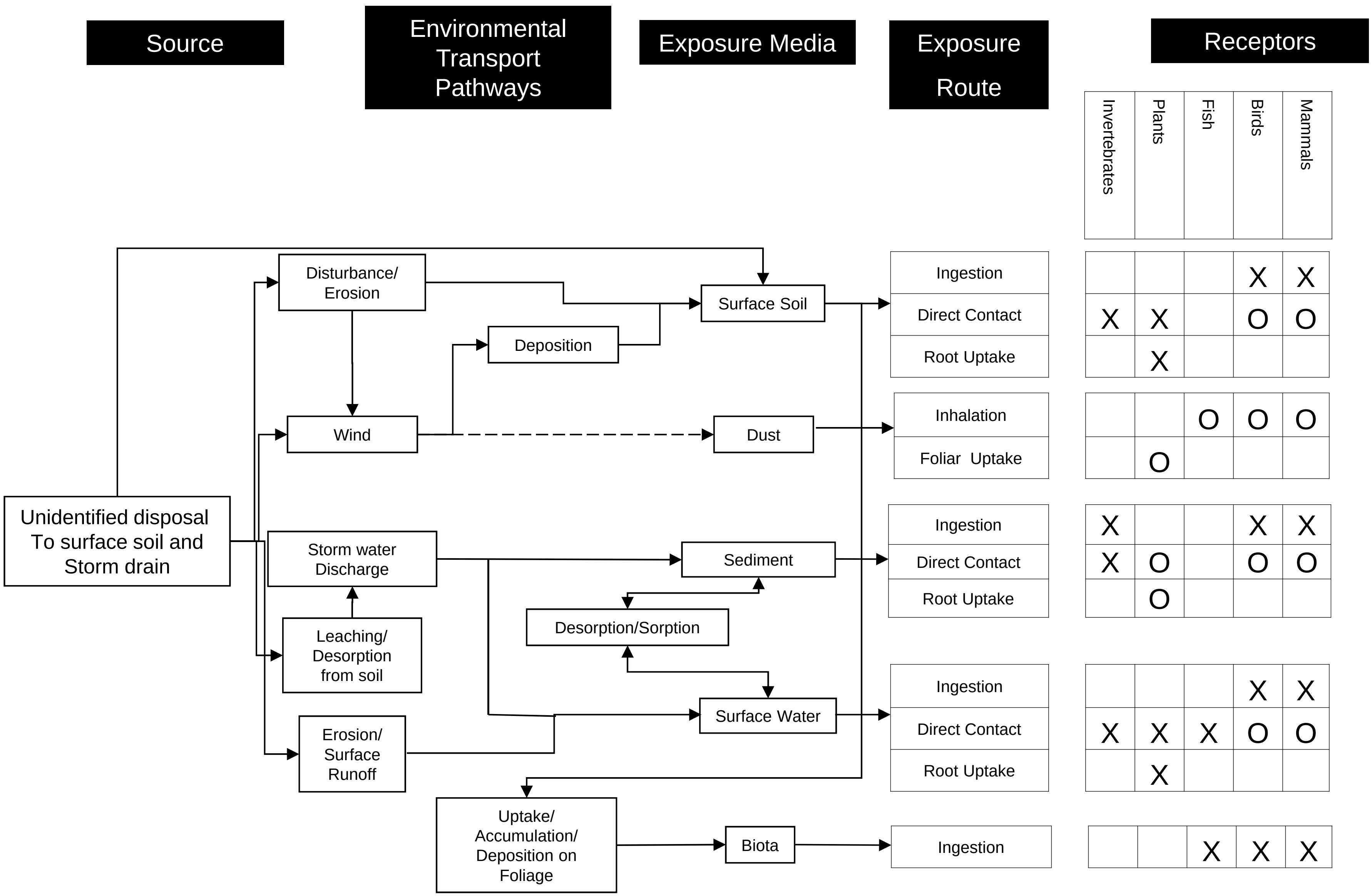
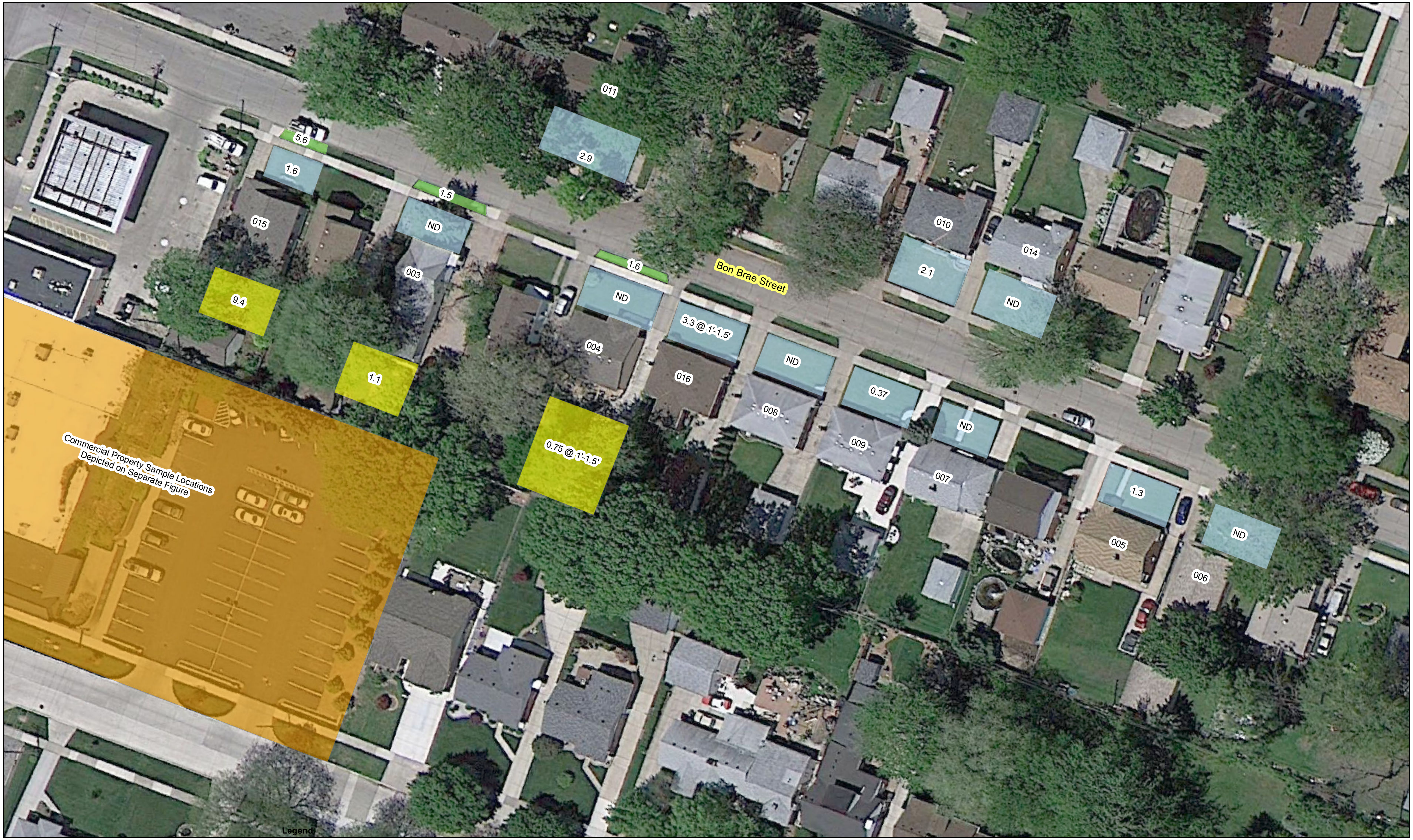


Figure 2-1. Ecological Conceptual Site Model
Ecological Risk Assessment, Ten-Mile Drain Superfund Site
St. Clair Shores, Michigan

__ = Pathway complete and significant
-- = Pathway complete and insignificant
X = Pathway evaluated quantitatively
O = Pathway evaluated qualitatively



N

0 25 50

Approximate scale in feet

Legend

Figure, Name

- Front Yard
- Parkway
- Back Yard
- Commercial Property

Notes:

1. ©Google Aerial Dated May 9, 2010

FIGURE 2-2
Bon Brae Street Residential Soil Sampling Locations
Ten-Mile Drain Remedial Investigation
Saint Clair Shores, Michigan

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\\cypress\proj\Army Corp\St Clair Shores\mcds\Remedial Investigation\Figure Renumber\TenMileDrain_Figure2-2_RI.mxd 04/07/2014

N

0 75 150
Approximate scale in feet

Legend

Back Yard
ND Non Detect for PCBs

Notes:
1. Hightest Concentrations for yard area are reported.
2. Highest concentrations occurred in the 0'-0.5' interval unless otherwise noted.

FIGURE 2-3
Lange Revere Steet Canals
Ten-Mile Drain Remedial Investigation
Saint Clair Shores, Michigan

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N

0 40 80

Approximate scale in feet

Legend

- Front Yard
- Parkway
- Back Yard
- Commercial Property

Notes:

1. ©Google Aerial Dated May 9, 2010
2. 2.2 @ [redacted] Lakeland is combined parkway and yard results.
3. Sample collected from 0-6 inch interval unless otherwise specified.
4. All resuls in mg/kg (parts per million).
5. 0XX indicates property location ID.
6. Red = Above 4 ppm, Blue = Below 4 ppm

Figure 2-4
Lakeland Street Residential Soil Sampling Locations
Ten-Mile Drain Remedial Investigation
Saint Clair Shores, Michigan

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Note:
1. ©Google Aerial Dated May 9, 2010
2. All soil boring locations begin with the prefix "TMD-SO-".
3. Soil borings are color coded based upon the greatest concentration detected within the boring.

FIGURE 2-5
Former Martin Drain Soil Sampling
Ten-Mile Drain Remedial Investigation
Saint Clair Shores, Michigan

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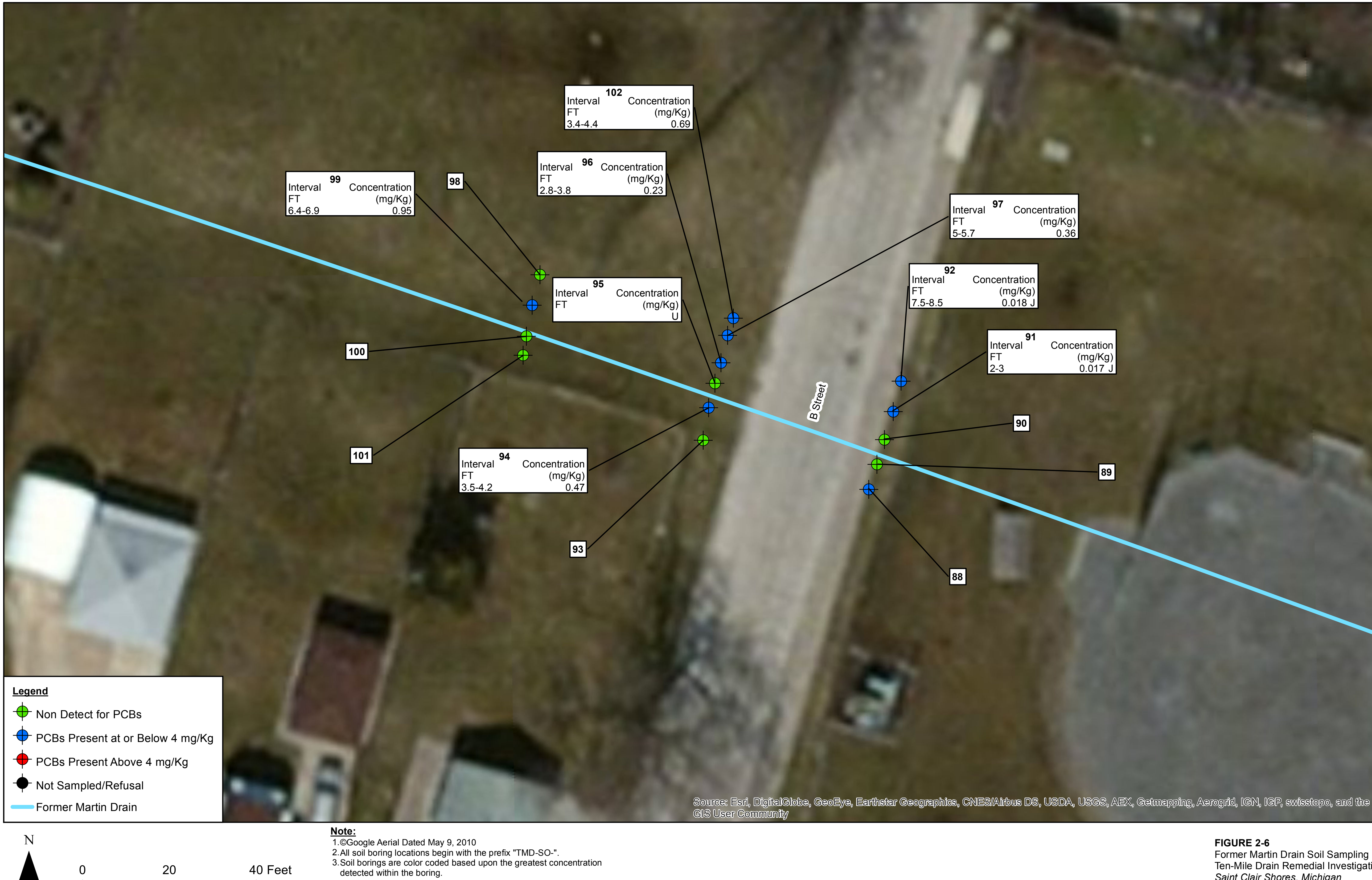

Note:

1. ©Google Aerial Dated May 9, 2010
2. All soil boring locations begin with the prefix "TMD-SO-".
3. Soil borings are color coded based upon the greatest concentration detected within the boring.

FIGURE 2-6
Former Martin Drain Soil Sampling
Ten-Mile Drain Remedial Investigation
Saint Clair Shores, Michigan

\\cypress\proj\army corp\Saint Clair Shores\MXDs\Remedial Investigation\Figure Renumber\TenMileDrain_Figure10_RI.mxd

CH2MHILL

Note:

1. ©Google Aerial Dated May 9, 2010
2. All soil boring locations begin with the prefix "TMD-SO-".
3. Soil borings are color coded based upon the greatest concentration detected within the boring.

FIGURE 2-7
Former Martin Drain Soil Sampling
Ten-Mile Drain Remedial Investigation
Saint Clair Shores, Michigan

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FIGURE 2-8

Sediment Locations Provided by Fields

Ten-Mile Drain Ecological Risk Assessment
Saint Clair Shores, Michigan

Appendix A
ProUCL UCL Calculation Outputs

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	12/28/2015 11:30:21 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total PCBs Soil

General Statistics

Total Number of Observations	320	Number of Distinct Observations	166
Number of Detects	149	Number of Non-Detects	171
Number of Distinct Detects	130	Number of Distinct Non-Detects	44
Minimum Detect	52.55	Minimum Non-Detect	19
Maximum Detect	23020	Maximum Non-Detect	440
Variance Detects	9037879	Percent Non-Detects	53.44%
Mean Detects	1976	SD Detects	3006
Median Detects	985	CV Detects	1.521
Skewness Detects	3.933	Kurtosis Detects	19.59
Mean of Logged Detects	6.976	SD of Logged Detects	1.071

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.569	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.267	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0726	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	946.7	Standard Error of Mean	126.8
SD	2260	95% KM (BCA) UCL	1159
95% KM (t) UCL	1156	95% KM (Percentile Bootstrap) UCL	1147
95% KM (z) UCL	1155	95% KM Bootstrap t UCL	1225
90% KM Chebyshev UCL	1327	95% KM Chebyshev UCL	1500
97.5% KM Chebyshev UCL	1739	99% KM Chebyshev UCL	2209

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.029	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.786	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.133	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.0792	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.948	k star (bias corrected MLE)	0.934
Theta hat (MLE)	2083	Theta star (bias corrected MLE)	2116
nu hat (MLE)	282.6	nu star (bias corrected)	278.3
MLE Mean (bias corrected)	1976	MLE Sd (bias corrected)	2045

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.176	nu hat (KM)	112.4
Approximate Chi Square Value (112.36, α)	88.89	Adjusted Chi Square Value (112.36, β)	88.79
95% Gamma Approximate KM-UCL (use when n>=50)	1197	95% Gamma Adjusted KM-UCL (use when n<50)	1198

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	920.1
Maximum	23020	Median	0.01
SD	2273	CV	2.471
k hat (MLE)	0.13	k star (bias corrected MLE)	0.131
Theta hat (MLE)	7081	Theta star (bias corrected MLE)	7034
nu hat (MLE)	83.16	nu star (bias corrected)	83.71
MLE Mean (bias corrected)	920.1	MLE Sd (bias corrected)	2544
		Adjusted Level of Significance (β)	0.0493
Approximate Chi Square Value (83.71, α)	63.63	Adjusted Chi Square Value (83.71, β)	63.55
95% Gamma Approximate UCL (use when n>=50)	1211	95% Gamma Adjusted UCL (use when n<50)	1212

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0877	Lilliefors GOF Test
5% Lilliefors Critical Value	0.0726	Detected Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	971.8	Mean in Log Scale	5.534
SD in Original Scale	2253	SD in Log Scale	1.646
95% t UCL (assumes normality of ROS data)	1180	95% Percentile Bootstrap UCL	1179
95% BCA Bootstrap UCL	1235	95% Bootstrap t UCL	1229
95% H-UCL (Log ROS)	1260		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	5.101	95% H-UCL (KM -Log)	1672
KM SD (logged)	1.989	95% Critical H Value (KM-Log)	3.082
KM Standard Error of Mean (logged)	0.139		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	999.7	Mean in Log Scale	5.83
SD in Original Scale	2242	SD in Log Scale	1.414
95% t UCL (Assumes normality)	1207	95% H-Stat UCL	1125

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL 1159

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix B
Fish Biota-Sediment Accumulation Factor Calculation

Appendix B. BSAFs for Forage Fish Reported in the EPA BSAF Database

Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Site ID	Superfund Site	Organism Common Name	Biota Tissue Supplemental	Biota Age Class	BSAF	Sed avg (mg PCB/kg oc)	Biota Avg (mg PCB/kg lipid)
SHEB01	Sheboygan River	smallmouth bass	composite	juvenile	20.4	0.1	1.9
SHEB01	Sheboygan River	smallmouth bass	composite	juvenile	10.6	0.7	7.7
GBAY01	Green Bay	rainbow smelt	composite	YOY	3.7	1.3	4.7
KALZ01	Kalamazoo River	Forage Fish Composite	Forage Fish Composite	NR	7.8	1.9	15.2
GBAY01	Green Bay	rainbow smelt	composite	YOY	2.6	6.7	17.4
GBAY01	Green Bay	alewife	composite	YOY	1.6	6.8	11.2
GBAY01	Green Bay	gizzard shad	composite	YOY	2.1	6.8	14.4
GBAY01	Green Bay	rainbow smelt	composite	YOY	1.5	7.4	11.2
GBAY01	Green Bay	alewife	composite	YOY	0.9	8.2	7.3
GBAY01	Green Bay	rainbow smelt	composite	YOY	0.9	8.5	7.4
SHEB01	Sheboygan River	smallmouth bass	composite	juvenile	12.3	27.7	341.3
HOUS01	Housatonic River	yellow perch	composite	<40 g	7.5	55.3	413.1
KALZ01	Kalamazoo River	Forage Fish Composite	Forage Fish Composite	NR	1.4	66.8	95.4
SHEB01	Sheboygan River	smallmouth bass	composite	juvenile	4.1	70.4	291.4
SHEB01	Sheboygan River	longnose dace	composite	NR	4.1	70.8	197.0
GBAY01	Green Bay	gizzard shad	composite	YOY	0.5	72.6	39.8
HOUS01	Housatonic River	largemouth bass	composite	YOY	9.3	74.2	689.6
HOUS01	Housatonic River	pumpkinseed	composite	<25 g	5.0	74.2	370.7
HOUS01	Housatonic River	yellow perch	composite	<40 g	5.7	74.2	419.5
HOUS01	Housatonic River	brown bullhead	reconstituted from fillet and offal	<100 g	3.4	167.2	571.1
HOUS01	Housatonic River	largemouth bass	composite	YOY	1.9	169.9	330.7
HOUS01	Housatonic River	pumpkinseed	composite	<25 g	1.8	169.9	313.0
HOUS01	Housatonic River	yellow perch	composite	<40 g	1.7	169.9	286.6
SHEB01	Sheboygan River	smallmouth bass	composite	juvenile	3.6	236.0	838.8
SHEB01	Sheboygan River	longnose dace	composite	NR	3.6	270.7	156.9
SHEB01	Sheboygan River	longnose dace	composite	NR	12.3	273.1	285.8
HOUS01	Housatonic River	white sucker	NR	<100 g	3.4	348.4	1173.6
HOUS01	Housatonic River	largemouth bass	composite	YOY	0.6	669.3	422.5
HOUS01	Housatonic River	yellow perch	composite	<40 g	1.0	669.3	665.0
HOUS01	Housatonic River	white sucker	NR	<100 g	0.6	2618.9	1441.9
				overall mean	5.0	213.2	256.0

NR - Not reported

YOY - young-of-the-year